Issued October 6, 1913.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, E. A. BIRGE, DIRECTOR; COLLEGE OF AGRICULTURE, UNIVERSITY OF WISCONSIN, H. L. RUSSELL, DEAN: A. R. WHITSON, IN CHARGE SOIL SURVEY.

SOIL SURVEY OF COLUMBIA COUNTY, WISCONSIN.

BY

W. J. GEIB AND ARTHUR E. TAYLOR, OF THE U. S. DEPARTMENT OF AGRICULTURE, AND GUY CONREY, OF THE WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY.

J. E. LAPHAM, INSPECTOR IN CHARGE NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1911.]

WASHINGTON:
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1913.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., March 15, 1913.

SIR: In the extension of the soil survey in the State of Wisconsin work was undertaken in Columbia County during the field season of 1911. This work was done in cooperation with the Wisconsin Geological and Natural History Survey, and the selection of the area was made after conference with State officials.

I have the honor to transmit herewith the manuscript report and map covering this area and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1911, as provided by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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SOIL SURVEY OF COLUMBIA COUNTY, WISCONSIN.

By W. J. GEIB and ARTHUR E. TAYLOR, of the U. S. Department of Agriculture, and GUY CONREY, of the Wisconsin Geological and Natural History Survey.

DESCRIPTION OF THE AREA.

Columbia County is located in the south-central part of Wisconsin. It is bounded on the north by Adams, Marquette, and Green Lake Counties, on the east by Dodge County, on the south by Dane County, and on the west by the Wisconsin River and Sauk County. The county has an extreme length east and west of about 39 miles and a width north and south of 25 miles. It embraces about 799 square miles, or 511,360 acres, some of which is of the finest agricultural land in the State.

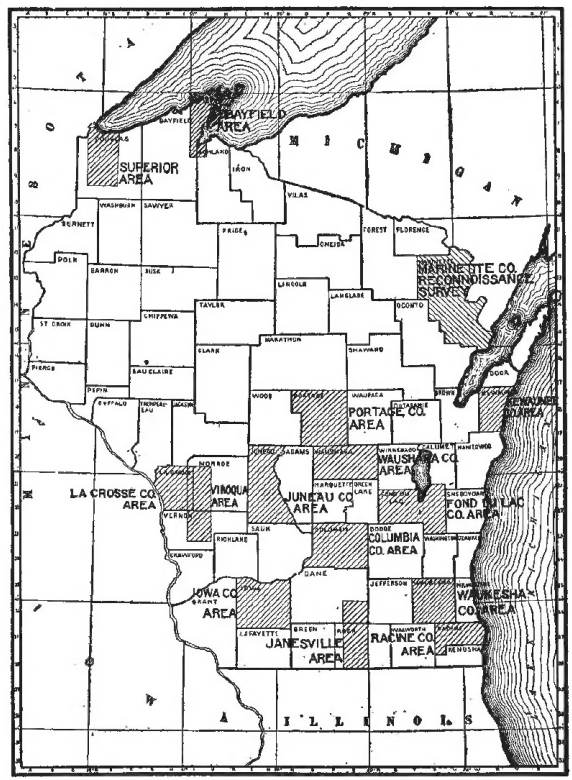

FIG. 1.—Sketch map showing areas surveyed in Wisconsin.

The topography ranges from broad level to undulating black prairies rising from 200 to 300 feet above the Wisconsin River to the rough and rugged hills of Caledonia Township, with steep, precipitous slopes broken by ravines and with numerous rock outcrops. An area intermediate between these two extremes comprises a region of some 70 square miles lying between Fall River and Randolph, and embraces a number of long, narrow, parallel ridges with intervening poorly drained areas of Peat and Muck.

The Wisconsin River flows through the western part of the county. In the northwestern corner its course is between steep sandstone cliffs from 30 to 75 feet high, frequently cut by tributary stream valleys. Below this point the river course continues through a broad flat valley until Dekorra is reached, beyond which point the valley again narrows, the steep slopes being dotted with outcrops of Potsdam sandstone. The remainder of the county is gently rolling to rolling, broken in some places by hills with rock outcrops and marked in others by moraines, lakes, marshes, and many flat, poorly drained areas.

Columbia County is drained by three river systems, the Wisconsin, Fox, and Rock. The Empire Prairie, between Leeds and Arlington, which forms the watershed, continues northeast to the Portage Prairie, south of Cambria, where it swings to the east for several miles, crossing into Green Lake County in a northerly direction about 2 miles from the corner of Columbia County. All of the territory east and south of this line drains into the Rock River system. North and west of this line the country drains into the Fox and Wisconsin Rivers.

The Fox and Wisconsin Rivers are separated by a drainage divide beginning in the high prairie north of Cambria and extending in a southwesterly direction to a point near Pardeeville, where it swings westward, continuing through Portage, and then northwest to a point about 2 miles south of Lewiston, leaving the county about 3 miles northeast of Kilbourn. The Wisconsin River and its tributaries drain about one-half of the county, the remainder being drained equally by the Fox and Rock Rivers. At Portage the Fox and Wisconsin Rivers are within 2 miles of each other. The water in the Wisconsin River is normally about 10 feet higher than in the Fox, a lock canal permitting boats to pass from one river to the other. During floods the Wisconsin River is with difficulty kept from cutting through the levees and pouring some of its waters into the Fox River.

Another interesting feature in the drainage of the county is that the numerous marshes, ponded valleys, lake beds, and lakes act as drainage basins for waters carried from the uplands by creeks and gullies, the water from these low-lying areas being carried by sluggish streams to the larger streams and rivers.

White men first entered this region between 1670 and 1675. Marquette and Joliet ascended the Fox, crossed the "portage," and went down the Wisconsin in 1673. The first permanent settlement was made near Poynette in 1836. The county was organized in 1846, and Portage made the county seat in 1857. The population consists mostly of people of foreign extraction, including Germans, Norwegians, Welsh, Irish, Scotch, English, and Dutch, and numbered 31,129 in 1910.

Portage, the county seat, is the largest city in the county, with a population of 5,440. It is an important railroad center and shipping point, with some manufacturing interests. Columbus, the second town in size, has a population of 2,523. A large canning factory is located here, and the city is in the center of a good farming country. Other towns and villages in the area are Kilbourn, Lodi, Randolph (partly in Dodge County), Cambria, Rio, Poynette, Wyocena, Pardeeville, Fall River, and Doylestown.

The county is well supplied with railroads, the main line of the Chicago, Milwaukee & St. Paul Railroad, between Chicago, Milwaukee, and Minneapolis, crossing it from southeast to northwest and passing through Columbus, Portage, Kilbourn, and intervening points. One branch of this line extends south from Portage to Madison through Poynette and Arlington, while another runs east through Pardeeville, Cambria, Randolph, and on to Beaver Dam and Minnesota Junction, where it joins a branch extending to Milwaukee. The main line of the Chicago & North Western from Chicago to Minneapolis and St. Paul crosses the southwestern corner of the area, passing through Lodi. A new line direct from Milwaukee to the Twin Cities crosses the northeastern corner of the county. A branch of the Soo Line extends north from Portage to Grand Rapids and Stevens Point. It is 93 miles from Portage to Milwaukee and 178 miles to Chicago via the Chicago, Milwaukee & St. Paul. From Lodi to Chicago it is 158 miles via the Chicago & North Western.

The towns within the county furnish a market for considerable farm produce and offer excellent shipping facilities to more distant points. Most of the live stock and creamery products are shipped to Chicago, Milwaukee, or other outside points. Tobacco is usually sold at the local warehouses.

The wagon roads of the county are in good condition, except in the north-central part of the area, where the sand is quite deep. Considerable attention is now being paid to road improvement. The school system is excellent, and the rural free delivery and telephone reach all parts of the county.

CLIMATE.

The climatic conditions prevailing in Columbia County are representative of a considerable area in the south-central portion of Wisconsin. The climate is healthful, though subject to extreme change in temperature. The winters are long and severe, the thermometer sometimes falling as low as —30° F. and the ground freezing to depths of 10 inches to 3 feet. The snow remains on the ground from December to March or later and protects such winter crops as clover, alfalfa, and wheat. The long winters necessitate careful

preparation for housing stock. The summers are comparatively short but pleasant. The mercury sometimes reaches 100° F. or more, giving a range for the year of more than 130°. The absolute maximum so far recorded at Portage is 106° F., though such extremes are rare. The hottest periods during the summer months seldom continue for more than a few days, and it is unusual for the temperature to remain below zero for more than a week at a time during the winter.

The following table, compiled from the records of the Weather Bureau station at Portage, shows the normal monthly, seasonal, and annual temperature and precipitation for a period of years:

Normal monthly, seasonal, and annual temperature and precipitation at Portage.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	°F.	°F.	°F.	Inches.	Inches.	Inches.
December	21.2	53	−30	1.56	1.95	2.05
January	18.2	52	−28	1.15	2.04	1.23
February	17.4	53	−27	1.02	0.40	2.39
Winter	18.9			3.73	4.39	5.67
March	31.1	75	− 7	1.81	0.44	2.30
April	46.3	89	12	2.81	1.65	2.96
May	58.7	95	25	4.01	2.26	7.13
Spring	45.3			8.63	4.35	12.39
June	66.7	102	31	4.11	0.82	9.98
July	71.4	106	44	3.35	2.05	1.79
August	68.7	97	43	3.23	2.80	3.17
Summer	68.9			10.69	5.67	14.94
September	61.3	92	25	2.83	1.65	3.90
October	50.0	85	13	2.13	0.50	1.29
November	35.8	71	−19	1.54	1.50	2.86
Fall	49.0			6.50	3.65	7.05
Year	45.6	106	−30	29.55	18.06	40.23

It will be observed that the normal winter temperature is 18.9°; spring, 45.3°; summer, 68.9°; and fall, 49°. The mean annual temperature is 45.6°.

The average rainfall of 29.55 inches is well distributed throughout the year, the average for the summer months of June, July, and August being 10.69 inches. The average date of the last killing frost in the spring is May 3, and of the first in the fall October 4, giving an average growing season of 150 days.

AGRICULTURE.

Agriculture in Columbia County dates back to 1836. The pioneers, accustomed to the forested lands of the East, were not favorably impressed with the long stretches of open prairie, and started their farming operations in the timbered regions or in the openings, where they thought the soil would be more productive than on the prairies. Later the prairies were also put under cultivation with very good results. Settlement of the county was quite rapid and portions of it early became agricultural regions of importance. Grain crops, including wheat, oats, barley, rye, and flax, constituted the larger part of the farm products for a number of years, wheat being the most important.

The severity of the winters on the open prairies caused the early settlers to plant their winter wheat in the clearings and the spring wheat on the prairies. Continued cropping under this system with no effort on the part of the owners to maintain the soil by the use of fertilizer caused yields to decline to a point where wheat was no longer profitable. The chinch bug also appeared and wheat farming gradually gave way to a more diversified system of agriculture. Corn and oats came to be more important, and stock raising, stock feeding, and dairying gradually developed. Potatoes were early found to be adapted to the sandy soils and soon became an important crop. Barley production also increased to considerable proportions. Tobacco was introduced in Dane and Rock Counties in 1858, and this crop soon spread to the surrounding regions, including Columbia County. The yields were excellent and the crop sold for cash. The tobacco grower became a stock feeder rather than a dairy farmer, and larger numbers of sheep and cattle were raised on the farms which produced the tobacco. When the natural meadows became inadequate to supply pasture tame grasses were seeded on the uplands. Continued cropping was the common practice, and it is only within about the last 20 years that any attention has been given to crop rotation. General farming is the prevailing type of agriculture in the county, supplemented in some sections by dairying, the production of special crops, or stock raising, depending upon local conditions.

The general farm crops of the region consist of corn, oats, barley, wheat, rye, clover, timothy, buckwheat, and some alfalfa. The corn crop of 1909 from 58,957 acres amounted to 2,014,287 bushels, or an average of about 34 bushels per acre. White and yellow dent corn are the types generally grown, although some farmers prefer the flint. Several improved varieties are being introduced by the Wisconsin experiment station, with marked improvement in the quality of seed and gradually increasing yields. The corn is usually

cut with a harvester and husked from the shock, the stalks being shredded or stacked for winter feed. The silo is coming into more common use, and considerable corn is now being preserved in the form of ensilage for winter feed. Corn is grown in all parts of the county, but the acreage is greater and the yields are larger in the prairie regions and on the Miami silt loam, deep phase, than over the sandy portions of the county.

The oat crop is also important, the acreage frequently exceeding that devoted to corn. In 1909 the crop from 59,695 acres amounted to 1,864,154 bushels, or an average of 31 bushels per acre. Comparatively little of the crop is sold, most of it being fed to stock on the farms. Swedish Select, New Kherson, and Big Four are among the varieties most extensively grown. The best oats are grown on the Miami silt loam, deep phase, though larger yields are often obtained upon the black prairie soils.

Barley is still an important cash crop, though the acreage is considerably below that of corn and oats. The crop of 1909 from 16,102 acres amounted to 438,827 bushels, or an average of about 27 bushels per acre. At present the acreage is decreasing, due to a decline in yields as the result of continued cropping, as was the case with wheat. On the heavy soils of the area barley gives very satisfactory yields when grown in rotation with other crops.

Wheat is being grown to a slightly greater extent at present than was the case a few years ago, although the acreage is still very small. The crop of 1909 from a total of only 1,970 acres amounted to 36,234 bushels, or an average of about 18 bushels per acre. Of this approximately one-fourth was winter wheat. The yields from this variety exceeded the spring wheat by nearly 4 bushels per acre. Danger of winter killing is given as the reason for the larger acreage of the spring wheat.

Rye is grown chiefly in the sandy portions of the county. It is produced as a grain crop, for green manuring, and for pasture. When the rainfall is sufficient fair crops are secured, though the average yield is low. The crop of 1909 from 11,255 acres was 141,199 bushels, or about 12½ bushels per acre. When used for green manuring the rye is usually sown on corn or potato land and plowed under the following spring. It may be pastured in the fall and early spring.

Timothy and red clover are the most common of the grasses and clovers used for hay and pasture. Considerable difficulty has been experienced during the past few years in securing a good stand of clover, due in part to winterkilling during the late winter when the snow is melting and the ground freezing and thawing alternately, and partly to the hot, dry weather during the late summer. An acid condition of the soil is not favorable for the best development of

legumes, including the clovers. The sourness of the soil weakens the development of the clover plant and makes it more susceptible to frost and drought. During the progress of the survey frequent litmus tests were made, and it was found that soil acidity was quite prevalent in varying degrees over the different soil types. On the heavier soils alsike clover is being grown to a considerable extent, as a stand can be more readily secured. Mammoth clover is used for pasture and also for hay on the lighter soils, but on the heavier types it becomes coarse and is not as satisfactory as the medium red clover. Timothy is being seeded by itself to some extent and cut for seed as well as for hay. Over the marshy parts of the area many tons of marsh hay are cut every year, furnishing an abundance of feed of inferior quality.

Alfalfa is being grown to a limited extent throughout the county. At least three cuttings can be secured, 3 tons per acre being about the average yield per year. This crop has passed beyond the experimental stage and can be grown successfully wherever the soil is kept in the proper condition. Liming is usually necessary, and to insure a good stand the field should be inoculated and also well supplied with stable manure.

Some buckwheat is grown, but the crop is of minor importance. Only 577 acres were planted in 1909, from which 7,546 bushels were harvested, averaging about 12 bushels per acre. It is grown chiefly in the low, sandy portions of the county.

Aside from the general farm crops common to this region, a number of special crops have been found well adapted to the soils of the area, and which have added materially to the profits of farming. Chief among these crops grown at present are potatoes, tobacco, beans, peas, and sugar beets. The acreage of most of the special crops raised could be profitably extended.

The potato is the most extensively grown of the special crops, the annual output for the county in 1909 from 7,098 acres amounting to 1,350,775 bushels, or an average of about 181 bushels per acre. The crop is confined largely to the sandy soils of the area, to which it is well suited. Yields are satisfactory as a rule and the tubers of good quality. A large part of the crop is sold soon after digging, although a number of warehouses have been constructed and some potatoes held for the late winter market. Some farmers store their own crop in cellars or pits and place them on the market in the spring. The most progressive farmers use modern machinery in planting, cultivating, and harvesting the crop. The Early Ohio is the most popular of the early varieties, while the Rural New Yorker, Pound, White, and Peerless are preferred as the later varieties.

Columbia County ranks fourth among the counties of the State in tobacco production. In 1905 the crop amounted to 3,142,475 pounds.

Most of the tobacco grown is of the Comstock Spanish variety. About 85 per cent of the crop is sold as binder tobacco and the remainder, consisting of broken leaves and stems, as filler. The average yield is about 1,100 pounds per acre. Binder tobacco commands prices ranging from 6 to 14 cents per pound and filler about 2 cents per pound. The crop is usually contracted for in the fields to be delivered after curing, the contract price depending upon the condition at time of delivery. An average price of 10 cents per pound is considered necessary to make the crop a profitable one. Tobacco is grown most extensively on the silt loam and fine sandy loam types. Because of the uncertainty of the crop and prices and owing to the labor required the acreage is being reduced and many of the tobacco growers are engaging in the dairy industry. The crop is fertilized with stable manure, as nearly every tobacco grower is a stock feeder and hence has a supply of manure on hand. Applications range from 20 to 40 loads per acre, but in spite of this heavy fertilization yields are reported to be on the decline. Generally speaking, tobacco is grown on the same field year after year, receiving the greater part of the manure, and as a result the remainder of the farm suffers. Commercial fertilizers have been used to a limited extent, but are not in favor with the farmers. Most of the farmers produce their own tobacco seed, but too often fail to use care in its selection.

Beans have been found to be well adapted to some of the soils of the area, especially the silt loam and fine sandy loam types, there being at present about 5,000 acres planted each year to this crop. In 1908, 69,000 bushels were produced, representing a little more than half the total production of the whole State. Beans are grown on nearly every upland soil type in the county, but probably do best on the silt loam and fine sandy loam. Yields average from 16 to 20 bushels per acre, sometimes running as high as 28 or 30 bushels. Prices range from $1.50 to $2 per bushel. The common practice is for the growers to sell their crop to seed houses for a definite price, the seed being furnished them and later deducted from the proceeds of the crop. The White Navy is the chief variety grown, though the Early Refuge and Brown Swede are also grown to some extent. Beans do best on a rich, friable soil and are most frequently planted after sod.

The growing of peas for canning purposes and for seed has developed into an important industry in some parts of the county. The four canning factories in the area are located at Columbus, Fall River, Randolph, and 2 miles north of Randolph. The Columbus plant is one of the largest of its kind in the country. In 1911 this factory handled the output from 1,500 acres, of which about two-thirds were grown in Columbia County. Yields range from 2,000 to 2,200 pounds

per acre of shelled peas, the farmers receiving an average price of 2 cents per pound. To save long hauls, viners are located throughout the pea-growing districts, making possible the extension of the industry beyond the immediate locality of the factory. A large seed company has located a warehouse at Columbus for milling and cleaning peas, and they have built up an extensive business in handling seed peas. In 1911 they contracted for about 1,300 acres in the vicinity of Columbus. This same company is also using 50 acres in seed tests and stock-improvement work. The canning companies also contract for seed peas in districts too remote from factory and viners. Yields of seed peas range from 15 to 20 bushels per acre and the price obtained ranges from $1.50 to $2 per bushel. The varieties grown are the Alaska, a very early pea, and the Advance, Admiral, and Horsford, which mature later. The crop is planted to mature continuously throughout a considerable period. Peas are reported to be a very profitable crop. Being a legume, they tend to build up the soil in the same manner as clover, and it has been noted that oats or barley yield heavier and produce grain of better quality after peas than following corn or other grain crops. During the season of 1911 the late peas were attacked by the pea louse, which did considerable damage. Early planting usually allows the crop to be harvested before this pest makes its appearance.

The Miami silt loam, deep phase, appears to be better adapted to pea growing than any other soil in the area. The crop does well on the Carrington silt loam, deep phase, but the quality is not as good as on the Miami silt loam, deep phase. When planted on Clyde soils the crop makes a rank growth of vine.

Sugar beets are grown to a considerable extent on the deep phases of the Carrington and the Miami silt loams. The farmers usually put in the crop and attend to the horse cultivating, while the sugar-beet companies furnish laborers to do the handwork, such as weeding, thinning, and topping, making an acreage charge of approximately $20 for this work. The crop is harvested and hauled to the shipping point by the farmer. Yields range from 10 to 18 tons per acre, for which a flat price is paid or settlement made according to polarization test. The price averages about $5.50 per ton. Tests are usually a little higher on the Miami than on the Carrington silt loam, deep phase, but the tonnage is usually higher from the latter soil.

Two salting stations have been established in the county to handle the cucumber crop, the growing of which has come to be quite an important industry on some of the sandy types of the area. About 15,000 bushels were harvested in 1911. A large pickling concern furnishes the seed and contracts for the entire crop. The cucumbers are planted in hills about 1½ feet apart, with 7 to 9 feet between the rows. Liberal applications of stable manure greatly increase the yields.

The average yield per acre is 150 bushels. The cucumbers are graded according to size. Those under $3\frac{3}{4}$ inches bring 75 cents and larger ones 35 cents per bushel. The crop runs about 60 per cent small and 40 per cent large cucumbers. Because of the large amount of work required in gathering the crop, there is seldom more than an acre put in by any one farmer. The White Spine is the most common variety grown.

Cabbage is being grown most extensively in the vicinity of Cambria. About 150 acres were planted in 1911. This crop does best on a rich, moist soil, and it is therefore confined mainly to the heavier types. The Holland variety is most commonly grown. The plants are ordinarily set out with a transplanting machine similar to that used in setting tobacco plants. Frequent cultivation, with some handwork, is necessary. When the crop is harvested the outside leaves and stems are returned to the field. Cabbage is generally considered a paying crop, yields averaging from 10 to 15 tons per acre and the price ranging from $4 to $6 per ton. The cost of production is placed by some farmers at about $2 per ton, though this is only a rough estimate. A large proportion of the crop is shipped to the wholesalers in the fall, but two warehouses have been built at Cambria for storing the crop for winter market.

Attempts have been made to grow cabbage on the same fields year after year, but cabbage rot soon appears, sometimes the second year, and this directs attention to the question of rotation. It is not advisable to take more than one crop of cabbage from a field during the rotation.

Considerable sorghum is grown on the sandy soils of the area, the quality being influenced to a certain extent by the texture of the soil. As this becomes heavier and the organic matter increases, the sirup becomes darker and less desirable. The output from the area in 1905 amounted to 3,746 gallons.

Trucking on a commercial scale has not been developed to any extent, though nearly every farmer has a garden in which most of the common vegetables are grown for home use. Near some of the towns small commercial truck gardens give good results. The sandy soils of the area are well adapted to a variety of truck crops, and where shipping facilities are adequate it would seem that this industry could well be considerably extended.

Fruit growing has not been developed on a commercial scale to any appreciable extent. Apples do fairly well on many of the soils and there are a number of small home orchards scattered throughout the county. Cherries, raspberries, blackberries, currants, plums, grapes, and strawberries are grown to a limited extent, chiefly for home consumption. It would seem that most, if not all, of these fruits could

be profitably grown to a greater extent than at present. Many of the slopes in Caledonia Township are well suited to apple orchards.

Dairying is an important industry, but should be developed to a much greater extent than it is at present. There are some purebred herds of Holstein, Jerseys, and Guernseys, but the greater proportion of the dairy stock consists of grade animals, largely Holstein and Shorthorn. A number of the herds are headed by a purebred sire and in this way the stock is gradually being improved. In 1911 there were 13 creameries and 9 cheese factories in the county. Many of the farmers have cream separators, hauling the cream to the creamery and feeding the skim milk to hogs on the farm. The dairy industry should be further developed. The silo is just beginning to be introduced, and with the extension of dairying the number should increase rapidly. Alfalfa should be grown on every farm in the county, as it furnishes an excellent feed and is a soil builder.

Beef cattle are raised quite extensively in the south-central and southwestern parts of the county. They are shipped in from northern and western points, fattened for the winter market, and sold after the holidays. The Shorthorns seem to be the most popular breed. In sections where feeding is carried on about 10 to 15 head per 100 acres are turned off every year.

Sheep are raised in nearly every section of the county and in the southern and western border districts, particularly in Caledonia Township, feeding for market is carried on quite extensively. Western sheep are shipped in during the fall to points near Lodi, where they are pastured until winter sets in, and then housed and fed until ready for market.

Hog raising is quite general in all parts of the county, being carried on in conjunction with general farming and dairying. From 20 to 40 hogs are kept on the average farm, except on the lighter soils of the northern part of the county, where 10 to 20 is the average number. The Poland-China seems to be the favorite breed, though Berkshires, Duroc-Jerseys, and Chester Whites are also raised.

Horses are not raised to any extent in the county, though a number of the farmers plan to breed their working mares and raise enough work stock for their own farms.

It is generally recognized throughout the county that many of the crops grown are much better adapted to certain soil types than to others. Potatoes produce higher yields of better quality on the sandy types than on the heavier soils. Sugar beets do much better on the Miami and Carrington silt loams, deep phase, than on the sandy types. Peas appear to do best on the Miami silt loam, deep phase. Corn does well on the Carrington silt loam, deep phase, and

the Clyde silt loam. On the latter type grains are apt to lodge and the quality is not as good as on the Miami soils. Cabbage requires a rich soil and is grown entirely on the Carrington and Miami silt loam, deep phase. Although the adaptation of certain soils to particular crops is recognized, the present farming practices do not always permit the realization of plans best suited to prevailing conditions.

A common rotation on the heavier soils consists of corn one year, followed by oats, barley, or wheat, with which clover and timothy are seeded for two years. Hay is cut for one or two years and the field frequently pastured for one year before being again plowed for corn. On the lighter soils potatoes are grown one year and followed by grain (rye and oats) for two years and then seeded to clover and timothy. Frequent failures with clover have interrupted the rotations of many farmers, but the usual plan is to have grass on the land every 4 or 5 years. Attempts at continual cropping on the same field with such crops as cabbage, peas, and tobacco are still common, but the average farmer has learned that this is not a profitable system and is not conducive to continued fertility of the land or profitable yields.

In general, however, more attention is being paid each year to the selection of crop rotations best suited to local conditions and soil types throughout the county. Methods of cultivation, fertilization, seed selection, etc., are also being given more consideration, with the result that agriculture is being placed upon a more scientific basis, with a tendency to adopt such practices as will maintain and increase the productivity of the soil.

Among the weed pests most common in Columbia County the Canada thistle, quack grass, and wild mustard are probably the most troublesome. The amount of damage caused by such pests is not fully appreciated, and all efforts looking to their eradication should be encouraged.

The buildings on the average farm in Columbia County are well constructed and substantial. Besides a frame or brick house, there is usually a barn with hay loft, a corn crib, shelter for cattle, hogs, and other stock, and where tobacco is grown, a large shed for curing this crop. The tobacco shed may also serve as a place for storing farm machinery. Although many farmers have their machinery kept under cover, there is room for improvement along this line.

Windmills are quite common, supplying water for stock and the home. Gasoline engines are being installed on many farms and used for pumping, grinding feed, sawing wood, churning, running washing machines, and sometimes an electric-lighting plant. Most of the fields are well fenced, many with barbed wire, though woven wire fencing is coming into more common use. Farm improvements vary

in different sections of the county, being best on the Carrington and Miami silt loams, deep phase, and poorest on the sand and fine sand types.

An inadequate supply of farm labor often makes it necessary for the members of the family to do a large proportion of the farm work. This condition frequently determines the type of farming practiced. On a monthly basis hands receive from $30 to $35, with board and washing included, and frequently the hired man's driving horse is cared for in addition. During haying and harvest time the day wage varies from $1.50 to $2. Wherever possible modern machinery is used, doing away with considerable manual labor.

The census of 1910 reported 2,554 farms in Columbia County, including 94.5 per cent of the total area of the survey. Of these 76.8 per cent are operated by the owners, and the remainder being nearly equally divided between share and cash tenants. The average size of farms is 141 acres, with an average of 92 acres improved. There are 585 farms which have 175 acres or more, 29 farms of 500 acres or more, and 3 farms which contain 1,000 acres or more. The value of farm lands varies greatly on the different types of soil. Much of the Miami and Carrington silt loam, deep phase, types is held at prices ranging from $125 to $150 an acre, while the poorest farms on the sand and fine sand types are worth only $15 to $25 an acre. Variations between these extremes depend upon location, character of the soil, and improvements.

While agriculture in the area as a whole is well developed, and while this area compares favorably with other parts of the State having the same soil conditions, there are, nevertheless, several lines along which further general improvements could be made. One great need of most of the soils of the area outside of the prairie regions and bottom lands is a larger supply of organic matter. This may be had by supplementing the stable manure with green manuring crops. Legumes are best for this purpose. Peat may also be used where bogs are convenient and no long hauls are necessary. The added organic matter will also increase the water-holding capacity of the soil. Nearly all of the soils are more or less acid, a condition which can be corrected by applications of ground limestone.

Crop rotations should be more carefully considered, with a view to securing combinations best suited to the various soils and increasing yields. The cultivation of intertilled crops could be improved by keeping a fine dust mulch on the surface during the growing season to conserve moisture and assist in carrying crops over dry periods, which are common, especially during late summer. Tests should be made to determine the value of commercial fertilizers in connection with the special crops which are grown in different parts of the county. The use of commercial fertilizers containing potash and

phosphoric acid may be necessary in getting a good stand of clover on some of the sandy soils of the area.

There is a tendency in some parts of the county toward farming too large tracts. A number of farmers are working from 200 to 300 acres, where if only 80 to 100 acres were cultivated and care given every feature of the work the net returns would be greater.

The question of drainage should also receive attention. Thousands of acres of lowland in the county could be reclaimed at small cost and made to produce excellent crops. On many of the farms in the upland tile drains could be installed to advantage. Up to the present time comparatively little tile drainage work has been done in the county, but in view of the high land values the expense would be more than repaid by increased producing acreage and larger yields.

Cooperation among farmers in marketing their produce through a central agency would make far better prices through elimination of middlemen's profits.

SOILS.

The soils of Columbia County, Wisconsin, have been grouped into 9 soil series, comprising 27 types, including Rough stony land, Muck, and Peat. Two of the types are residual and of minor importance, and with the exception of these and Muck and Peat all of the soils owe their origin to the weathering of glacial débris of the Late Wisconsin ice sheet. Much of this material has been influenced during and since its deposition by wind and water action and the accumulation of organic matter.

The underlying rock of the county has contributed very largely to the formation of the soils, much of the material carried by the ice sheet being deposited near by. The eastern and southern parts of the county are underlain by limestone, the greater proportion of which is Lower Magnesian. In the extreme northeastern and southeastern corners of the county are small areas, over which the surface rock is the Trenton limestone. Immediately beneath this and overlying the Lower Magnesian limestone is the St. Peters sandstone, which forms the surface rock over only a very small area about the margin of the Trenton. The central, northern, and most of the western parts of the county have the Potsdam sandstone as the surface rock, while west of the Wisconsin River in Caledonia Township a considerable tract of pre-Cambrian rocks, mostly quartzite, constitute the surface rock. These last-named rocks have contributed but slightly to the soils of the area, because of their hardness and the fact that they occur near the point where the ice sheet stopped. The action of the glacier was, therefore, not nearly as pronounced in this section as over other formations in the county. Some ma-

terial foreign to this region, including stones and bowlders of various kinds from the north, has also been brought in and mixed with the local glacial débris.

According to origin, the soils of Columbia County may be divided into eight general groups. The first includes the Miami fine sand, fine sandy loam, and loam, the Coloma fine sand, fine sandy loam, and the Carrington loam and fine sandy loam, all of which have been derived through weathering of the drift laid down by the Late Wisconsin ice sheet. The Miami series comprises only the light-colored, timbered, glacial soils carrying a considerable amount of the parent limestone material. Gravel beds in the Miami regions frequently contain over 95 per cent of limestone gravel. The Coloma series includes light-colored, timbered glacial soils, carrying little or no limestone, and largely derived from the Potsdam sandstone. The Carrington series includes dark-colored, prairie, glacial soils.

The second general group includes the Miami and Carrington silt loams, deep phase, which owe their origin chiefly to the weathering of a silty loesslike covering of the glacial till.

In the third group are the Plainfield silt loam, fine sandy loam, fine sand, sand, and sandy loam, and the Genesee sand and fine sand. These types owe their origin to glacial drift stratified by running water. The Plainfield series includes light-colored and stratified glacial material, occurring as overwash plains, terraces, or filled-in valleys, while the Genesee series is confined to the light-colored, water-laid material within the present flood plains of streams.

In the fourth group are the Fox fine sandy loam and fine sand. This series includes light-colored water-laid material, occurring as overwash plains, terraces, or filled-in valleys. They differ from the Plainfield in being derived largely from limestone material.

The fifth group includes the Clyde silt loam, loam, fine sandy loam, fine sand, and some Muck, all of which were formed from modified drift material with accumulations of organic matter. The Clyde series includes the black, low-lying soils of the glacial regions. These soils are high in organic matter. When the organic-matter content is high, but not sufficient to class the material as Peat, it is called Muck.

The sixth group contains the Peat derived almost entirely from the accumulation of partially decomposed vegetation.

The seventh group includes the Boone sand and the Rough stony land, both of which are largely residual soils, derived from the weathering and disintegrating of the Potsdam sandstone.

The eighth group includes the Knox silt loam. The series of this name embraces the light-colored silty soils, seemingly due to wind action. The silt loam is the only representative of this series in the county.

The following table gives the name and extent of each of the soils mapped in the county:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Miami fine sandy loam	110,400	21.6	Coloma fine sandy loam	6,592	1.3
Miami silt loam deep phase	101,120	19.8	Genesee fine sand	5,504	1.1
Carrington silt loam, deep phase	70,464	13.8	Plainfield fine sandy loam	2,560	.5
Peat	51,264	10.0	Plainfield sand	2,240	.4
Miami fine sand	43,584	8.5	Plainfield silt loam	1,728	.3
Clyde silt loam	19,712	3.9	Rough stony land	1,664	.3
Plainfield fine sand	19,264	3.8	Miami loam	1,536	.3
Clyde fine sandy loam	15,040	2.9	Boone sand	768	.2
Carrington loam	11,840	2.3	Knox silt loam	768	.2
Coloma fine sand	11,648	2.3	Fox fine sandy loam	704	.1
Fox fine sand	9,344	1.8	Plainfield sandy loam	640	.1
Muck	8,448	1.7	Clyde fine sand	640	.1
Carrington fine sandy loam	6,720	1.3	Genesee sand	512	.1
Clyde loam	6,656	1.3	Total	511,360	

MIAMI SILT LOAM, DEEP PHASE.

The surface soil of the Miami silt loam, deep phase, consists of a light-brown, friable silt loam about 10 inches deep, with a limited content of organic matter, but high in silt. The color of the typical soil varies with the moisture content, the surface presenting an ashy appearance when dry. The subsoil is a yellow silt loam, becoming heavier with depth and grading at 20 to 24 inches into a yellowish-brown silty clay loam. This material continues to a depth of 3 to 6 feet, where the true glacial till, consisting of a mixture of sand, silt, clay, and gravel, is encountered. The upper subsoil sometimes contains small lenses of very fine sand, while the lower subsoil may be slightly mottled with yellowish red or brown, due to unequal oxidation of the material. There is a sharp line of demarcation between the loesslike material and the underlying true glacial till, stones, bowlders, or gravel being almost or entirely lacking in the upper portion, but rather numerous below. The gravel in the till consists chiefly of limestone.

While the type as a whole is very uniform, there are some variations worthy of note. Where associated with the fine sand or fine sandy loam the surface soil contains considerable fine sand and the subsoil may be a sandy clay at depths ranging from 16 to 36 inches, approaching more closely the subsoil of the Miami fine sandy loam than that of the true silt loam. Where the type borders the Carrington silt loam, deep phase, the Clyde soils, or where encountered on lower slopes and in depressions the surface and subsoils are somewhat

darker than typical. The subsoil of the type along the border of areas of Clyde silt loam is frequently a pale yellow, with ferruginous mottlings. On the tops and upper slopes of hills and ridges the surface soil is often more shallow than the typical, while along the lower slopes the soil frequently reaches a depth of 12 to 16 inches.

The Miami silt loam, deep phase, resembles the Knox silt loam quite closely in color and texture and frequently has a loesslike structure. It is underlain, however, by true glacial till and derived in part at least from that source. The Miami silt loam, deep phase, also resembles the Carrington silt loam, deep phase, in texture and structure and has nearly the same origin. It is light colored and was originally forested, while the Carrington soils are dark colored and are found chiefly in prairie regions.

The Miami silt loam, deep phase, is one of the most extensive and important types in the county. A large tract of this soil is found in Caledonia Township, west of the Wisconsin River, and separated from a smaller area in the northwestern part of the county by this stream. Another large body of this class of land is found in the southwestern part of the survey, extending from the vicinity of Lodi west to the Wisconsin River. The Lodi tract is separated from more of the same soil in the vicinity of Columbus, in the southeastern part of the survey, by an extensive tract of Carrington silt loam, deep phase, which occupies Empire Prairie. A few smaller, scattered areas are found in various parts of the county.

In general the surface of the type is gently rolling, yet there is a wide range in the topographic features developed. Between Columbus and Randolph the type occupies the tops and sides of drumlins and drumloidal flutings, while for some distance west of Columbus it occupies all of the surface except the low, poorly drained areas. West of Lodi the surface becomes quite rolling, while in Caledonia Township, west of the Wisconsin River, it is broken by extensive ridges and hills. Differences of 600 feet in elevation within a mile are common. On some of the steeper slopes there is danger of surface erosion, although damage from this source to date has been comparatively unimportant.

On account of the uneven surface, the natural drainage of the type is excellent and drainage as a whole is well established. There are a few draws and low places where tile drains could be installed to advantage.

The Miami silt loam, deep phase, is derived mainly from the weathering of the loessial mantle overlying the glacial till, and to a slight extent from the weathering of the till itself. The former shows no reaction with hydrochloric acid for limestone material, while the latter does. The surface shows traces of acidity, from which the till is free. This till bed, which varies in thickness from 2 to 100 feet,

consists of a heterogeneous mass of bowlders, gravel, rock fragments, silt, sand, and clay. About 90 per cent of the gravel and almost all of the rock fragments and bowlders are of limestone. The other rocks are of granite, gneiss, diorite, basalt, quartz, quartzite, porphyry, sandstone, and argillite. The depth of the till bed between the silty covering and the parent rock does not appear to be as great in the western part of the county as in the eastern part. West of the Wisconsin River the Huronian quartzite forms extensive ridges and outcrops in places, while east of the river, in the southwestern part of the county, outcrops of sandstone and some limestone are frequently seen. The residual material from these rocks has modified the soil locally to a limited extent.

The type was originally covered with a growth of white, red, and bur oak, basswood, butternut, hickory, and maple. Most of the land is cleared, the forested areas being confined to the steeper slopes in Caledonia Township.

A large part of the soil is under cultivation, the nonarable land representing less than 1 per cent of the type. General farming and dairying are the prevailing forms of agriculture. All of the general farm crops common to the region and several special crops are successfully grown. Corn, oats, barley, wheat, clover, and timothy give excellent results. From the standpoint of quality of the crops, the Miami silt loam, deep phase, is not excelled by any of the other types in the county, although the Carrington silt loam, deep phase, and the Clyde silt loam will produce larger yields of some of the farm crops.

Corn, which is the leading crop on the Miami silt loam, deep phase, averages about 40 bushels to the acre, while oats, which rank next in importance, yield an average of 35 bushels. Barley has been extensively grown, but both the acreage and the average yields are on the decline at present, only about 20 bushels per acre being secured. Wheat is grown only to a limited extent and the yields are small. On account of drought and other causes it has been difficult to secure a good stand of clover for the past few years. As a result some farmers have become discouraged and seed their land to timothy alone.

A number of special crops on this type are yielding the growers satisfactory returns. In the vicinity of Columbus, Randolph, and Fall River peas for canning are being grown, yields ranging from 1,800 to 2,000 pounds per acre. When they are allowed to mature, the seed peas average about 15 bushels per acre. Beans are grown quite extensively and average about 20 bushels per acre. The yield of sugar beets ranges from 10 to 15 tons per acre of good quality, the sugar content being higher than from beets grown on the Carrington soils. Some tobacco is grown, yielding from 1,000 to 1,500 pounds per acre. Potatoes are grown to a limited extent and give fair yields.

The best farmers on the Miami silt loam, deep phase, use a rotation consisting of corn, followed by a small grain, such as oats, barley, or wheat, and then seeding with clover and timothy. Small grain may be grown for two years. Hay is cut for one or two years and may be pastured a year, after which the field is manured and again plowed for corn. When there is not sufficient manure a crop of clover or clover and timothy is frequently plowed under, which not only adds to the fertility but also increases the water-holding capacity of the soil. Although a number of farmers attempt to practice a definite rotation, there are many who do not make any special effort in this direction.

The Miami silt loam, deep phase, is comparatively easy to cultivate, and when worked under favorable moisture conditions no difficulty is experienced in securing a good seed bed. Where the surface soil is shallow, as is the case on some slopes, the underlying heavier material may be turned up by the plow and prove rather difficult to pulverize.

Wherever good methods of farming are being followed the productivity of the soil is gradually being increased, but where careless methods are practiced yields are gradually declining. The importance of maintaining the fertility of this type can not be too strongly urged.

The average yields now being produced on this type are considerably below the capacity of the soil when properly handled. Plowing is frequently too shallow and cultivation irregular and insufficient. Corn is often cultivated but two or three times, though shallow cultivation at intervals might well be continued until the husks begin to turn. There is seldom sufficient manure to properly fertilize the fields, and for this reason green manuring should come into more common practice. When the soil is acid, ground limestone should be applied at the rate of 1,500 to 2,000 pounds per acre. This will largely obviate the difficulty now experienced over many areas in securing a stand of clover. More attention should also be given to definite crop rotations. Alfalfa can be successfully grown where the soil is well drained and not acid, although inoculation is necessary. This crop should be tried on every farm, especially where dairying is practiced. The dairy industry could be profitably extended.

MIAMI LOAM.

The surface soil of the Miami loam consists of a grayish-brown loam about 10 inches deep, carrying considerable fine sand and silt. The subsoil is a yellowish-brown sandy clay, becoming heavier with depth and continuing to about 2 feet, where the underlying till bed, consisting of sandy clay, gravel, and bowlders, is encountered. This bed extends to a depth of many feet. Crystalline and limestone

bowlders and rock fragments occur throughout the soil section and on the surface, but never in sufficient quantities to interfere with cultivation.

Where the type borders the Miami and Carrington silt loam, deep phase, the soil is silty and darker than usual.

The type is not extensive and is confined to a few small areas in the eastern one-third of the county. The largest of these is found north of Cambria along the county line. The topography is for the most part gently rolling, and the natural drainage is good.

The type has been derived from the weathering of the glacial till underlying this region. The surface soil is frequently in an acid condition which does not exist in the subsoil.

The original forest growth consisted of white, red, and bur oak, elm, basswood, butternut, and some hickory and poplar. Practically all of the best timber has been removed.

About 70 per cent of the Miami loam is under cultivation, the remainder being mostly in pasture or gently rolling woodland.

The type is a very good general farming soil, and all of the crops common to the region can be grown upon it with satisfactory yields. Corn averages 35 bushels, wheat 15, rye 20, oats 30, and potatoes 100 bushels, and clover and timothy 1½ tons per acre. Although tobacco, beans, and peas have been grown very little on this type, they give good yields.

The methods of farming are essentially the same as those practiced on the deep phase of the Miami silt loam. The soil is a little more difficult to handle than the Miami fine sandy loam, but when plowed under proper moisture conditions no trouble is experienced in establishing a good seed bed.

The greatest need of this soil is a larger supply of organic matter, which may be secured by supplementing the stable manure with green manuring crops. Ground limestone should be applied over areas showing indications of acidity. Dairying should be developed to a greater extent and crop rotations practiced. The rotations suitable for the Miami silt loam, deep phase, will also be found suitable for this type. Alfalfa can be grown by inoculating the soil and correcting acidity.

Farms on the Miami loam range in value from $40 to $100 an acre, depending upon location and improvements.

MIAMI FINE SANDY LOAM.

The surface soil of the Miami fine sandy loam consists of a loose, porous, light-brown fine sand or light fine sandy loam about 10 inches deep, containing only a small amount of organic matter. The material is usually rather loose and the downward movement

of water through the surface soil is rapid. The subsoil consists of a yellowish or yellowish-brown fine sand, slightly sticky at depths of 15 to 20 inches, and which grades into a compact reddish-brown or dark-brown sandy clay at 20 to 36 inches. The deeper portion consists of a mixture of sand, gravel, stones, and clay and extends to considerable depths, as indicated by road cuts and well borings. Bowlders, rock fragments, and pebbles of limestone origin are found throughout the soil section, but rarely in quantities to interfere with cultivation.

On the lower slopes of hills and ridges and the lower-lying portions of the type where the water table approaches the surface the soil is darker in color, due to accumulations of organic matter. The underlying sandy clay occurs at depths of 1 to 3 feet. At a few points along the northern boundary of the county a red clay similar to the Superior clay was encountered at a depth of 2 to 3 feet. All of these variations are of comparatively small extent, as compared with the area of the whole type, and while they affect to some degree the agricultural value of the type the difference is not great enough to justify their separation.

The Miami fine sandy loam is the most extensive type in the county and is important from an agricultural standpoint. Large areas are found in the central and north-central parts of the county. One area extends from a point a few miles north of Portage eastward to within 4 or 5 miles of the northeast corner of the county. Another large area occurs in the vicinity of Doylestown, extending westward to the Wisconsin River and north to Duck Creek. Other smaller areas are scattered throughout the county, with the exception of the extreme northwest and the extreme southeast corners and the prairie regions.

The type may be said to represent a gradation from the silty soils of the southern, eastern, and western parts of the county toward the fine sand types with which it is associated. Its continuity is frequently broken by low, level, and poorly drained areas embracing Peat, Muck, and the Clyde soils, and also by level sandy areas where soils of the Plainfield and Fox series are encountered.

The topography varies from gently rolling to rolling. This feature, in conjunction with the sandy nature of the soil and the sand and gravel in the subsoil, accounts for excellent natural drainage. Over the deeper areas of sand the type is inclined to be droughty, but where the underlying sandy clay approaches the surface the ability of the soil to withstand drought is nearly equal to that of the Miami silt loam, deep phase.

The rainfall is readily absorbed by the sandy soil, except during unusually heavy precipitations when there is some surface run-off

through regular drainage channels. No damage from erosion results except on the steepest hillsides.

The type has been derived from the weathering of the unassorted glacial till modified by lateral and recessional morainic material. Where the sand is deepest the surface has been influenced somewhat by wind action, although this feature is not so pronounced as on the Miami fine sand type. Although there is considerable limestone material mixed with the gravel, the type shows traces of acidity over much of its extent.

The original forest growth consisted chiefly of white, red, and bur oak, hickory, maple, and butternut, with some elm in the lower areas. Practically all of this has been removed and the land placed under cultivation.

With the exception of a few pasture woodlots on the rougher areas the Miami fine sandy loam is practically all under cultivation. The prevailing type of agriculture consists of general farming and the growing of a few special crops. Dairying, though gradually extending, is still of minor importance.

The general farm crops most commonly grown are corn, which averages 35 bushels; oats, 30 bushels; barley, 30 bushels; wheat, 17 bushels; rye, 20 bushels; and timothy and clover mixed, about 1½ tons per acre.

Of the special crops beans yield from 20 to 35 bushels, Irish potatoes about 125 bushels, and tobacco from 1,000 to 1,300 pounds per acre. The quality of the tobacco grown is superior to that produced on the Carrington silt loam, deep phase.

There is a wide variation in methods of cultivation on this soil, and as yet no definite rotation has been worked out which proves especially adapted to local conditions. It is customary to plant corn or potatoes on fields which have been in sod. If potatoes are planted first this crop may be followed by corn, after which a small grain, such as oats, barley, wheat, or rye, is grown, followed a second year by a small grain with which timothy and clover are seeded. Hay is cut for one or two years, or the field pastured the second year, before being plowed again. Beans are usually sown in fields following sod to which a good supply of manure has been added.

Stable manure is the only fertilizer used on this soil to any extent. A crop of clover is plowed under occasionally, but the practice of green manuring is not at all common. When tobacco is grown manure is liberally applied and frequently at the expense of the remainder of the farm. Commercial fertilizers are not used to any extent.

On account of the sandy nature of the type, the soil is easily cultivated, and a good seedbed can be secured with a comparatively small amount of labor.

Where the type is farmed scientifically and a definite crop rotation is followed, as is being done by some of the leading farmers, the productiveness of the soil is being gradually increased.

The type as a whole is deficient in organic matter and water-holding capacity. Much of it is in an acid condition, and the yields on the whole are not as high as they should be. To overcome these difficulties the supply of stable manure should be supplemented by plowing under green manuring crops. The acidity can be corrected by applications of ground limestone at the rate of 1,200 to 2,000 pounds per acre. In order that surface evaporation may be checked the ground should be covered by a crop as much of the time as possible. For this purpose rye is frequently sown in the corn or after potatoes and allowed to grow in the fall. The rye provides some fall and early spring pasture and may be plowed under. Attention should be directed to the selection of a crop rotation which will meet the requirements of the type.

The dairy industry should be more extensively developed with a view to maintaining the fertility of the soil and increasing the efficiency of the farm. When the acidity is corrected and the soil supplied with manure, alfalfa can be successfully grown by inoculation with soil from an old alfalfa field. Potatoes and beans could be profitably grown to a greater extent, and the trucking industry could also be successfully developed. The type is well adapted to cucumbers, strawberries, tomatoes, and a number of other garden crops. Bush berries also do well. Apples are not grown on a commercial scale, but they can be successfully produced, especially for home use.

Farms on this type range in value from $40 to $90 an acre, depending upon location, improvements, and the condition of the soil.

MIAMI FINE SAND.

The Miami fine sand consists of a light-brown, loose, incoherent fine sand, which is low in organic matter. At about 9 to 10 inches the material is light yellow, becoming lighter with depth, until at 30 to 36 inches it is an almost white fine sand of loose and open structure. The till bed, consisting of a mixture of sand, gravel, silt, and bowlders, is encountered at depths of 4 to 6 feet. Small quantities of limestone gravel and bowlders occur on the surface and throughout the soil section but are seldom sufficiently numerous to interfere with cultivation.

The type is subject to some variation, though none of the phases were of sufficient extent or importance to indicate separately on the map. On the lower slopes and in depressions the surface is darker and contains a larger amount of organic matter than the typical soil. Such areas are slightly loamy and have a somewhat higher agricul-

tural value than the rest of the type. In a few places a sticky sand is encountered at a depth of 30 to 36 inches. A few gravel beds are scattered throughout the type, such deposits having only a shallow surface covering of soil. Exposed areas are sometimes wind-drifted, small dunes being formed. In general the Miami fine sand is lighter in texture and lower in agricultural value than the Miami fine sandy loam, with which it is closely associated.

The Miami fine sand is most extensively developed in the central part of the county, in Pacific and Wyocena Townships, with scattered areas in Fort Winnebago, Marcellon, Lowville, Dekorra, and the northern part of Lodi Townships. There are only a very few areas in the eastern third of the country or along the southern border, where the Carrington silt loam, deep phase, and Miami silt loam, deep phase, predominate. The type is associated with the Miami fine sandy loam and its continuity is frequently broken by areas of Peat, the Clyde series, or in some places by level, sandy tracts of Plainfield or Fox soils.

The topography of the type varies from gently rolling to rolling. The surface is sometimes broken by sand dunes and depressions, though rarely to such an extent as to render cultivation impracticable. Owing to the loose, open structure of the material and to the surface configuration, the natural drainage is excessive and the soil as a whole is droughty. There are only a few kettle basins and dune depressions which are not connected with drainage channels, and even in these places the drainage is usually sufficient, owing to the sandy nature of the deeper subsoil. Except during the heaviest rains, storm waters are rapidly absorbed by the soil, and danger from erosion through surface run-off is reduced to a minimum.

The type is largely of glacial origin and has been derived from the weathering of the glacial till, somewhat modified by wind and stream action. The weathering of the limestone fragments in the underlying till has a tendency to correct any acidity existing in the soil material, though this is often counteracted by leaching, leaving the type more or less acid.

The original forest growth consisted chiefly of white, red, and bur oak, with some hickory, and hazel brush. All of the merchantable timber has been cut, but the scrubby growth of oak and hazel bushes has been allowed to remain on a few of the poorest portions of the type.

About 75 per cent of the type is under cultivation, while approximately 22 per cent remains in untilled pasture land. About 2 per cent consists of sand dunes and about 1 per cent of moraines, kettle basins, and regions too stony and rough to be of any value except for pasture.

The general farm crops common to the region are grown. Corn under normal conditions will average 25 bushels to the acre, oats

22 bushels, rye 12 bushels, and timothy and clover about 1 ton. Potatoes yield as high as 150 to 175 bushels per acre when given special attention, though the average is lower than this for the whole type. Beans and tobacco, which are grown quite extensively on the fine sandy loam, are not grown to any great extent on the fine sand, and the yields are considerably lower. Cucumbers do well and satisfactory yields are secured, though the crop is not grown very extensively.

No definite crop rotation is practiced on this type as a whole, but one which was found to give good results in some sections consists of corn followed by oats one year, then by rye for one year with clover and timothy seeded for hay. The hay is usually cut for one year and the second year pastured, after which the land is plowed again for corn. Where manure is available it is usually applied to the sod. Green manuring is not practiced to any extent and commercial fertilizers are seldom used. Another rotation which has given success on similar sandy soils consists of potatoes, followed by a small grain, such as rye or oats, and the land seeded to clover. The first crop of clover may be cut for hay and the second plowed under for green manuring. If sufficient manure is available the second crop of clover may be left for seed. Corn may be grown in place of potatoes if desired. Where the soil conditions are made favorable alfalfa may be successfully grown on this soil, though it is more difficult to secure and maintain a good stand than on a heavier soil. The soil is well adapted to truck crops, especially where the type is close to shipping points or home markets.

The soil is easily cultivated on account of its loose, open structure, and under good methods of farming the productivity of the type should gradually increase. The methods followed at present over a large proportion of the type are not such as tend to bring about this result.

The lack of organic matter in the soil and its low water-holding capacity should be corrected by supplementing the stable manure with green manuring crops. Where peat beds are available the peat may be spread on the surface and plowed under, supplemented by commercial fertilizers containing potash and phosphoric acid. Where an acid condition exists in the soil, ground limestone should be applied. Farms range in value from $25 to $75 an acre.

CARRINGTON SILT LOAM, DEEP PHASE.

The surface soil of the Carrington silt loam, deep phase, consists of a dark-brown to almost black friable silt loam, having a smooth feel and containing a large amount of organic matter. The subsoil consists of a dingy brown silt loam in the upper portion, becoming lighter in color and heavier in texture with depth, until at 20 to 24

inches it grades into a brownish or yellowish-brown silty clay loam or silty clay changing to yellow with traces of red at depths of 3 to 4 feet. The typical glacial till, consisting of clay, silt, sand, and bowlders, is found at depths of 4 to 6 feet. The line of demarcation between the yellow silty clay and the unassorted till is well defined, the upper portion being free from bowlders and gravel and leached free of calcium carbonate. The depth to bedrock ranges from 2 to 30 feet.

With the exception of a few small areas, the Carrington silt loam, deep phase, is uniformly developed throughout its extent. Along the border of the fine sandy loam and loam members of the series both surface and subsoil contain considerable fine sand. Along the contact of the Miami silt loam, deep phase, the texture remains typical, but the color is lighter than usual. Where the Carrington silt loam, deep phase, is associated with the Clyde silt loam a number of steps appear in the weathering of the subsoil, grading from the dark or drab subsoil of the Clyde to the dingy brown or yellow of the Carrington. The water table becomes lower and soil oxidation more marked with improved drainage conditions. Over some of the limestone hills the soil is shallow, the soil mantle consisting of 7 to 10 inches of a dark-colored silt loam, resting upon a dingy-brown silt loam which becomes heavier but lighter in color with depth. Both soil and subsoil in such areas contain limestone fragments with some outcrops of the bed rock, and over the eskers crystalline and limestone bowlders and gravel are encountered.

The type resembles the Miami silt loam, deep phase, in texture, structure, and, to a certain extent, in mode of origin. It differs from the Miami, however, in that it is much darker in color, contains more organic matter, has a more nearly level topography, and occupies prairie regions instead of forested sections.

The Carrington silt loam, deep phase, is one of the leading agricultural types of southeastern Wisconsin and is also extensively developed in Fond du Lac, Dodge, Dane, Rock, Walworth, and Racine Counties and to a more limited extent in some of the other counties in this section of Wisconsin. The main area of the type in this county, comprising about 60 square miles, is found in the vicinity of Arlington and is known as the Empire Prairie. Other areas are found northwest of Columbus and in the vicinity of Cambria.

The topography varies from level to gently undulating, the only exception to this is found in a few isolated groups of limestone hills which rise abruptly from 20 to 50 feet above the general level of the country, and in a few winding eskers filled with bowlders and gravel.

Because of the undulating topography and long, gentle swells or slopes, erosion is not a factor of importance. There are but very few marshes within the areas of the Carrington silt loam, deep phase, the

drainage waters being largely carried beyond the limits of the prairies. The high organic-matter content and level surface of the type facilitates the rapid absorption of water, making cultivation easy under ordinarily careful management, and renders the soil more retentive of moisture. The underlying till and the gently undulating surface give fairly good natural drainage, though there are a number of places where tile could be installed to advantage.

The material composing this type is derived from the weathering of the loesslike covering overlying the glacial till. The prairie regions were doubtless in a poorly drained condition before the streams and gullies had an opportunity to produce the present surface drainage and when the ground water stood at a higher level. The resulting moist condition prevented the growth of trees, but was suitable for grasses and sedges. The residue from the partial decay of this growth accounts for the high organic-matter content and the dark color of the soil. The calcium carbonate has been quite thoroughly leached from this soil, and the surface material is now in an acid condition.

The Carrington silt loam, deep phase, is a prairie type, and the only forest growth upon it was confined to the borders of the prairie and on the limestone hills and ridges. The original growth consisted of some oak, hickory, and other hardwoods.

With the exception of a very few isolated hills and ridges, all of the Carrington silt loam, deep phase, is under cultivation. It is highly improved and farming communities have an appearance of thrift and prosperity. The type of agriculture followed consists chiefly of general farming, in conjunction with which a number of special crops are grown. The dairy industry is developed only to a limited extent, although present indications apparently favor its further development, with a corresponding reduction in some of the special crops, notably tobacco.

Of the general farm crops, corn yields about 42 bushels, oats 38 bushels, barley 30 bushels, wheat 15 bushels, and mixed timothy and clover hay about 2 tons to the acre. Some clover and timothy are grown separately, and the seed is occasionally allowed to mature. Only a very small amount of alfalfa is grown.

Tobacco is among the most important of the special crops grown, yields ranging from 1,000 to 1,600 pounds per acre, and the product selling for 2½ to 14 cents per pound, according to quality and market conditions. Beans are grown quite extensively, yielding from 15 to 23 bushels per acre. Potatoes are grown only to a limited extent, chiefly for home use. The quality is not so good as when grown on the light-colored soils. The average yield is about 130 bushels per acre. Sugar beets are grown extensively in the vicinity of Arlington and south to the county line, yields ranging from 13 to 18 tons

per acre. The sugar content averages about 14 per cent, which is 2 per cent below the average test of beets grown on the deep phase of the Miami silt loam. Larger yields on the Carrington silt loam, deep phase, however, make this a more desirable soil for this crop. Cabbage does well on this type, and in the vicinity of Cambria, where extensively grown, yields of 12 to 14 tons per acre are secured. Seed peas average about 15 bushels per acre. A few peas are also grown for canning, but this industry is confined mainly to other soil types.

Comparatively few farmers follow a carefully worked out crop rotation, although where corn is followed by small grains, and the land then seeded to clover and timothy, and this sod well manured before again being plowed for corn, a marked improvement in the soil results. The special crops grown are usually inserted in the rotation without much thought as to their place. Tobacco is often grown on the same field for at least two or three years, and is usually followed by corn, potatoes, or beans. Owing to heavy applications of manure on the tobacco crop, good yields of the crops which follow are secured.

Owing to the high organic-matter content and the large amount of silt present, this type is comparatively easy to cultivate, and a fine, mellow seed bed can be secured with little difficulty. Stable manure is the only fertilizer used, and where tobacco is grown it is applied so liberally that the available supply is generally exhausted before other parts of the farm receive adequate applications. From 20 to 40 loads of stable manure per acre are put on the tobacco fields. Despite its high humus content, the soil responds readily to fertilizer treatment.

The dairy industry is not developed to any important extent on the Carrington silt loam, deep phase, but is gradually increasing, while tobacco raising is on the decline. Wherever dairying has been followed for any length of time the soil appears to be in a higher state of fertility than on farms where tobacco has been grown. The reason for this is that in dairy farming a larger amount of manure is produced and evenly distributed over the fields.

The type as a whole is in an acid condition. Acreage applications of 1,500 to 2,000 pounds of ground limestone will correct the acidity. subsequent applications of half this amount may be made once during each crop rotation. Applications of rock phosphate are also beneficial. Both these substances may be applied to the land mixed with manure as a top dressing and harrowed in.

A definite crop rotation, including one or more legumes, is of prime importance in maintaining the productiveness of the type. Stable manure should be equally distributed over the cultivated fields instead of favoring special crops, such as tobacco, to the prejudice of the remainder of the farm, as has heretofore been the common prac-

tice. Dairying should be extended, accompanied by an increase in alfalfa production. A rotation well adapted to the area consists of corn, oats, or barley for one year, followed by clover or clover and timothy mixed. Sugar beets, beans, and cabbage make excellent special crops.

The type ranges in value from $75 to $150 an acre, depending upon location and improvements. The average price is about $100 an acre.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of the deep phase of the Carrington silt loam:

Mechanical analyses of Carrington silt loam, deep phase.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
311545	Soil	0.0	1.0	2.2	5.0	7.5	62.9	21.1
311546	Subsoil	.4	1.5	4.2	11.5	5.5	58.1	18.5

CARRINGTON LOAM.

The surface soil of the Carrington loam is a dark-brown to black friable loam, from 10 to 12 inches deep, containing an appreciable amount of silt and fine sand and considerable organic matter. The upper portion of the subsoil consists of a dark-brown loam, grading at 16 inches into a compact, yellowish-brown sandy clay loam, which continues to a depth of 22 to 30 inches, where more sandy material is usually encountered, grading at 36 inches into a sandy clay. Small limestone fragments about the size of a pea are common at depths ranging from 20 to 36 inches. Limestone fragments and crystalline bowlders occur throughout the soil section. The clay content is variable, in some cases being sufficient to make plowing difficult, except under favorable moisture conditions.

The Carrington loam is much less extensive than the Carrington silt loam, deep phase, with which it is associated. The largest areas are located several miles south and southwest of Rio, south of Cambria, and in the northeastern section of the county.

The surface is undulating to gently rolling, the main body of the type being crossed by several gravelly ridges. Numerous small streams and gullies have formed an almost complete drainage system throughout the type. None of the type is sufficiently steep to suffer from erosion.

The type has been derived from the weathering and disintegration of the underlying glacial till, which is encountered at depths of from 6 to 40 feet. The loesslike silty mantle overlying the till which is so conspicuous in the Carrington silt loam, deep phase, is not developed

over this soil, except to a very small extent, the silt being insufficient to justify the classification of the type as a silt loam. Tests with litmus paper show a strong acid reaction.

As the type occupies an open prairie, there was practically no forest growth originally, the native vegetation consisting entirely of grasses.

Although nearly all of this soil could be cultivated, the percentage of the area in farms is considerably less than is the case with the Carrington silt loam, deep phase. Where the type is farmed the methods are poor and many of the fields are allowed to remain idle. About the same crops are grown as on the silt loam, but the yields are lower. Corn averages about 35 bushels, oats 30 bushels, barley 25 bushels, wheat 13 bushels, and timothy and clover mixed about 1½ tons to the acre. Of the special crops, tobacco yields from 1,000 to 1,400 pounds and beans about 15 bushels per acre. In Randolph Township seed peas yield about 18 bushels per acre. Potatoes are of better quality than on the deep phase of the silt loam and average 125 bushels per acre, but are not grown on a commercial scale.

Probably a larger proportion of the farms on this type are devoted to dairying than on the silt loam, deep phase, although the industry can not be said to be extensively developed.

No definite crop rotations are practiced on this soil. Rye is sometimes sown in the fall as a winter cover crop and plowed under in the spring. Seeding is usually with oats or barley, as the amount of wheat now grown is small. Some difficulty has been experienced in getting a good stand of clover during the past two years, chiefly, it is thought, on account of the dry weather.

Since the type as a whole is in an acid condition, ground limestone should be applied at the rate of 1,500 to 2,000 pounds per acre. The dairy industry should be extended and the acreage devoted to corn increased. Where the soil is limed alfalfa can be grown successfully, if the fields are inoculated. This crop should be grown on every farm, particularly those devoted to dairying. This soil will undoubtedly respond to the use of rock phosphate, and applications of 500 to 600 pounds per acre should be tried. About half this amount will be sufficient for subsequent applications, to be made once during each rotation. The growing of beans, sugar beets, cabbage, and similar crops could be profitably extended.

The price of land of this type ranges from $75 to $100 an acre, depending upon improvements and location.

CARRINGTON FINE SANDY LOAM.

The surface soil of the Carrington fine sandy loam to an average depth of 11 inches consists of a dark-brown to black fine sand, containing considerable organic matter, which gives it a slightly loamy

character. It is underlain by a lighter-colored fine sand, becoming sticky at a depth of 16 inches and heavier in the lower section, until at 2 or 3 feet it grades into a yellow friable fine sandy clay with a reddish tinge. Variations in depth occur over limited areas. Limestone fragments and crystalline bowlders are common throughout the soil section.

This type is of minor importance in the county. It is associated with the Carrington loam and silt loam, deep phase, and the Miami fine sand and fine sandy loam.

The topography varies from undulating to gently rolling, and the surface is broken somewhat by small gravelly ridges. Natural drainage is good, although the type may be droughty over areas where the sandy clay is over 3 feet below the surface. It is less susceptible to drought than the Miami fine sandy loam under similar conditions, on account of the greater amount of organic matter in the surface soil.

This type, like the Carrington loam, is derived from the weathering of the glacial till. The surface has probably been influenced to some extent by wind action. The litmus test indicates that the soil is acid and in need of lime.

The native vegetation consists chiefly of grass, with some bur oak, white oak, and poplar.

Most of the general farm crops common to the region are grown upon this type, with fairly good results. Corn averages about 35 bushels to the acre, oats 30 bushels, and hay 1½ tons. Of the special crops, potatoes yield about 125 bushels, beans 15 bushels, and tobacco 1,000 to 1,200 pounds per acre. Farming methods are similar to those employed on the Carrington loam. Little attention is paid to the question of crop rotations best suited to the soil. Some difficulty is experienced in securing a good stand of clover.

Since the soil is acid the application of ground limestone would prove beneficial, and when the condition is corrected it is thought there will be less trouble in getting a stand of clover, and alfalfa can probably be successfully grown. Green manuring could well be practiced on this soil to supplement the stable manure. The question of crop rotations should be carefully considered and trials made to determine the combination of crops which could be grown most successfully on this soil.

COLOMA FINE SANDY LOAM.

The surface soil of the Coloma fine sandy loam consists of a light-brown to gray light fine sandy loam or fine sand, about 10 inches deep. The material is open and loose in structure and low in organic matter. The subsoil is a light-yellow or pale reddish yellow fine sand, which becomes sticky at 15 to 20 inches and grades into a compact reddish or yellowish-brown sandy clay at 22 to 36 inches. Crystalline

rock fragments, gravel, and bowlders and some chert and sandstone fragments occur on the surface and throughout the soil section, but not in quantities sufficient to interfere with cultivation. The gravel and rock fragments are more plentiful in the subsoil than in the surface section, being sufficiently numerous in places to interfere with boring.

The lower slopes and depressions bordering the lowlands show a darker surface soil, due to accumulations of organic matter. In small areas on some of the narrow hilltops and steeper slopes the sandy covering has been eroded, leaving exposed the sandy clay subsoil. In other places the sandy covering is shallower than typical. In a few places the sticky sandy subsoil was not encountered above 24 to 28 inches, but all of these variations are of small extent and could not be indicated separately. A small area of sandy soil underlain at a depth of 2 feet by Superior clay was found along the northern boundary in Lewiston Township. This area was too small to be separated in the map.

The Coloma fine sandy loam is similar in texture, structure, and topography to the Miami fine sandy loam, but differs from that type in that it does not contain any appreciable amount of limestone material.

The type is confined to Newport and Lewiston Townships, in the northwestern part of the county, where it is associated with the Coloma fine sand. It is of comparatively small extent, having a total area of only 6 or 8 square miles.

The surface of the type is gently rolling to rolling and dotted with marshes and depressions into which the drainage waters find their way. On account of the topography and the texture of the soil, the natural drainage is excellent. There is sufficient silt and clay in the subsoil to make the type quite retentive of moisture, and it seldom suffers from drought except during the most extended dry periods. On the steeper slopes the surface has been eroded in places and small gullies formed, though the damage from this source is slight.

The Coloma fine sandy loam is derived from the weathering of glacial till, some of which doubtless represents terminal and recessional moraines. The material is unassorted, the rock fragments and bowlders consisting of granite, gneiss, quartz, sandstone, and a number of other rocks. Limestone is found in this drift only in small quantities. In most places Potsdam sandstone constitutes the parent rock. Litmus tests indicate that the soil material is acid.

The original forest growth consisted chiefly of white, red, and bur oak, with some hickory and other varieties of hardwood. There are still some woodlots on this type, but all of the best trees have been removed. The uncultivated areas are used chiefly for pasture.

With the exception of some of the steeper slopes, kettle basins, and woodlots, which are all of small extent, the type is largely under cultivation, and all of the general farm crops common to the region are grown. Corn averages about 30 bushels, oats 25 bushels, rye 15 bushels, and timothy and clover 1 ton per acre. Potatoes yield about 125 bushels. The methods of cultivation, fertilization, and crop rotations followed are similar to those practiced on the Miami fine sandy loam, though as a whole this type is somewhat less productive than the Miami.

The chief type of agriculture followed consists of general farming, with a tendency toward an increase in the dairy industry, which at present is not extensively developed.

The soil of this type is deficient in organic matter and is in an acid condition. The humus content may be increased by supplementing the stable manure with green manuring crops, and the acidity can be corrected by the application of ground limestone. When the condition of the soil has been thus improved alfalfa could be successfully grown. The extension of the dairy industry would tend to maintain the fertility of the land and increase its productiveness. The following of well-selected crop rotations and more persistent cultivation of intertilled crops will result in better yields.

Land values range from $25 to $75 an acre, depending upon location, improvements, and condition of the land.

COLOMA FINE SAND.

The surface soil of the Coloma fine sand, to an average depth of 9 inches, consists of a loose, incoherent light-brown fine sand, containing but little organic matter. The subsoil is a loose, incoherent fine sand, 3 feet or more in depth, and grading from a light brown to a light yellow as the lower portion is approached. Crystalline and sandstone gravel and rock fragments occur in both soil and subsoil, but in quantities too small to interfere with cultivation. A few gravel beds covered by a thin mantle of surface soil are found throughout the type. This type differs from the Miami fine sand in the absence of limestone gravel or rock fragments.

The organic-matter content varies over different sections of the type, being higher in the depressions where the moisture conditions have favored the accumulation of humus-forming material. Where lenses of clay in the underlying till occur at depths of 3 to 5 feet below the surface the type is not quite so droughty as where the sand is of greater depth. Small dunes formed by wind-blown sand are occasionally found.

This type is confined to the northwestern part of the county, in Newport, Lewiston, and Fort Winnebago Townships. All of the

type lies west of the Fox and north of the Wisconsin Rivers. It is closely associated with the Coloma fine sandy loam.

The surface of the type varies from gently rolling to rolling. On account of its loose, open structure the natural drainage is somewhat excessive and the type is likely to suffer from drought, except during seasons of excessive rainfall. Erosion is not a serious problem on this type, the rainfall being rapidly absorbed and the surface run-off reduced to a minimum.

The material composing the Coloma fine sand consists of glacial débris, most of which occurs in the form of lateral and recessional moraines. The glacial débris here is very largely made up of fine sand, due to the fact that prior to this deposition the ice passed over the Potsdam sandstone, grinding off the rock and transporting the material for some distance. The soil and subsoil of the Coloma fine sand contain no limestone material and are usually more acid than the corresponding type of the Miami series.

The original forest growth consisted chiefly of white, red, and bur oak, with some hickory and other hardwoods. Part of the area is now overgrown with hazel brush. A few woodlots remain, but most of the forest has been cut.

About 60 per cent of the Coloma fine sand is under cultivation to the general farm crops common to this region. Corn gives an average yield of about 25 bushels, oats from 20 to 25 bushels, rye 15 bushels, timothy and clover 1 ton, and potatoes from 75 to 100 bushels per acre. By careful cultivation, rotation, and fertilization these yields have been nearly doubled by some farmers.

Over most of the type but little attention is given to the selection of a rotation particularly adapted to this soil. The methods of cultivation are similar to those followed on the other sandy types of the county. The soil is loose and open and very easily cultivated.

It may be said of this type as a whole that the methods now followed upon it are not such as tend to increase its productivity, although there are exceptions where more up-to-date methods are being practiced.

Early truck crops could be successfully grown on this soil, and this industry should receive greater attention.

In general the type is deficient in organic matter and in water-holding capacity, and the soil is usually acid. By supplementing the stable manure with green manuring crops, humus-forming material can be increased and the soil made more retentive of moisture, and by applying ground limestone the acidity can be corrected. With such improvement clover will doubtless do better, and a good stand of this crop will materially increase the productiveness of the soil. A rotation consisting of a small-grain crop, clover, and potatoes would probably be found suited to this type. The second crop of

clover should be plowed under and stable manure should be applied as liberally as the farm supply will permit.

The following table shows the results of mechanical analyses of samples of soil and subsoil of this type:

Mechanical analyses of Coloma fine sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
311553	Soil	0.2	9.5	22.4	56.7	3.8	4.6	2.5
311554	Subsoil	.0	6.2	19.4	64.0	5.3	3.4	1.6

PLAINFIELD SILT LOAM.

The surface soil of the Plainfield silt loam consists of a light-brown silt loam, about 12 inches deep, having an extremely smooth feel. Under normal moisture conditions the soil is quite friable, but when wet it becomes slightly sticky. The subsoil is a yellowish-brown silty clay loam, extending to a depth of 30 to 36 inches. The upper portion is high in silt and in many cases might be classed as a heavy silt loam. The clay content, however, increases with depth, and at about 2 feet the material is a silty clay loam. At 30 to 36 inches the heavy subsoil grades abruptly into a bed of fine sand of undetermined depth.

Over a small part of the type the surface has a yellowish to grayish-brown color and varies in depth from 10 to 14 inches. In places the underlying fine sand is encountered at 2 feet, although over most of the type it lies below the reach of a 3-foot auger.

The Plainfield silt loam is not extensive, occupying an area of only about 3 square miles. It occurs as a continuous body from one-half to 1 mile wide along the Baraboo River in the northern part of Caledonia Township. At a number of places this type grades into the Clyde silt loam. It resembles the Clyde in texture, but has a much lighter color.

The topography is level, the only variation being a few old sloughs formed when the Baraboo River flowed at higher levels and through channels which changed from time to time. Natural drainage is somewhat defective. The river channel and the old sloughs, however, afford an excellent outlet for tile drains, which if properly installed would satisfactorily drain the entire type. The underlying bed of sand furnishes good underdrainage. The type is not subject to overflow, except during periods of extremely high water, which occur at intervals of 6 to 10 years. Such inundations affect only the portion lying immediately along the river.

The type represents sediments deposited by the waters of the Baraboo and Wisconsin Rivers when they flowed at higher levels than at present. The underlying sand was probably deposited by the Wisconsin River and the silty material by the Baraboo.

The original native vegetation consisted chiefly of elm, ash, hickory, and oak. Most of the good trees have been cut.

Probably about 40 per cent of the type is under cultivation, the remainder being in forests and pastures. All of the type could be tilled if cleared, though the uncleared portion is in more danger of being flooded than the part now cultivated. The principal crops grown in the order of the rotation generally followed are corn, oats, and hay. No special attention is given to the selection of rotations best suited to this particular soil. The yields secured are reported to be slightly lower than on the Miami silt loam, deep phase, and the type is considered somewhat less desirable, chiefly on account of the danger of floods. The methods of cultivation and fertilization compare closely with those followed on the Miami silt loam, deep phase.

Under normal moisture conditions the type is comparatively easy to cultivate, although there are times in the spring when it becomes necessary to delay cultivating and planting until the land has drained. Less trouble and delay are experienced in this respect, however, than on the Clyde silt loam, with which the type is associated in the Baraboo Valley.

Adequate drainage through the use of tile or open ditches is the chief requisite of this type. Under good drainage conditions the soil should prove equal at least in producing power to the Miami silt loam. Dikes could be constructed at a comparatively low cost, which would effectually protect the land from inundations. The type is well adapted to all general farm crops and lies within 6 miles of Portage, which is a good market and shipping center.

Farms on the Plainfield silt loam are held at approximately $45 an acre.

PLAINFIELD FINE SANDY LOAM.

The surface soil of the Plainfield fine sandy loam to an average depth of 10 inches consists of a brown fine sandy loam containing enough silt and clay to make it slightly sticky when wet. The organic-matter content is higher than in the fine sand type. The subsoil is a fine sandy loam, lighter in color than the soil, and gradually becoming heavier in texture until a light sandy clay is encountered at a depth of 2 feet. Below this the material again becomes lighter and grades into a bed of fine sand at less than 5 feet. The type is subject to some variation, especially in the character of the subsoil. The surface soil is uniformly a fine sandy loam, but frequently the subsoil below 16 or 18 inches is a fine sand.

The type is of small extent, comprising less than 4 square miles. The largest area lies directly south of Portage, on the south side of the Wisconsin River.

The topography is level or slightly undulating and the natural drainage is good. South of Portage there are low-lying areas where the water table is comparatively near the surface, so that there is frequently an excess of moisture, especially in the spring and early summer.

The soil represents stream-laid material deposited when the river flowed at higher levels than at present. All the areas occur within the Wisconsin River Valley, but the largest area, the one south of Portage, is protected from overflow by a levee. Litmus tests indicate that the soil is acid.

The original forest growth consisted chiefly of white and red oak, with some hickory and other hardwoods. Much of the type along the Wisconsin River is now in woodlot or pasture.

About one-third of the type is under cultivation to the general farm crops. South of Portage much of the type is wet early in the season. It is used chiefly for hay and pasture.

The type is well adapted to trucking where the moisture conditions are regulated by drainage, and this industry might well be extended, as the type is within easy reach of shipping points and local markets. Applications of stable manure supplemented by the plowing under of green manuring crops will maintain the fertility of the soil. The acidity can be corrected by acreage applications of 1,500 to 2,000 pounds of ground limestone. Where drainage is defective tile drains should be installed.

PLAINFIELD FINE SAND.

The surface soil of the Plainfield fine sand is a loose, incoherent, light-brown fine sand, about 10 inches deep. It is free from gravel and stones and contains very little organic matter. The subsoil is a yellow fine sand. The material is loose and incoherent and becomes lighter in color with depth. It contains lenses or thin beds of stratified gravel. At depths of 2 to 3 feet large gravel beds are sometimes encountered. The lower lying areas are darker in color, owing to accumulations of organic matter.

The largest bodies of the type are found in Lewiston Township along the headwaters of the south branch of Neenah Creek, and occupy the level lands southward to the Wisconsin River. The other areas occur along both sides of the Wisconsin River to the west and south of Portage both in and out of the river valley.

The topography is comparatively level, with some undulations, due chiefly to wind action, which has formed low sand ridges and dunes. On account of the loose, open structure of the soil, the natural drain-

age is complete and sometimes excessive, especially on the higher portions of the type.

The Plainfield fine sand consists chiefly of reworked glacial material redeposited by water action in old valley flood plains, old valley fills, and outwash plains. The parent rock, from which most of the material has been eroded by glacial action, consists chiefly of Potsdam sandstone. The surface soil of this type shows acidity when tested with litmus paper.

The original forest growth consisted largely of oaks and poplar, with some sycamore, elm, and willows in the lower situations where the water table approaches the surface more closely than usual.

More than half of the type is under cultivation to the general farm crops, of which corn yields an average of 25 bushels, oats 20 bushels, rye 15 bushels, potatoes 100 bushels, wheat 12 bushels, buckwheat 15 bushels, and hay about 1 ton per acre. Of the special crops, tobacco yields from 1,000 to 2,000 pounds per acre and beans average about 12 to 15 bushels. Some trucking is practiced over a part of the type. Where a heavy dressing of stable manure is applied, cucumbers yield as high as 125 to 150 bushels per acre.

Very little has been done in the line of selecting crop rotations adapted to this particular type and farming methods are not such as tend to increase the productivity of the soil. The type is easily cultivated and no difficulty is experienced in securing a good seed bed with a minimum amount of labor. Because of the loose and incoherent structure of both soil and subsoil the decomposition of organic matter is rapid, and where humus is not present in large amounts the soil is inclined to be droughty.

This soil responds quickly to fertilization. Wherever possible stable manure should be supplemented by green manuring crops. Most of the type is situated near areas of Peat, and this material could well be spread upon the surface and plowed under to replenish the organic supply. In such cases commercial fertilizers containing phosphoric acid and potash should also be applied. Where the soil is acid applications of ground limestone will be found beneficial. Wherever possible clover should form a part of the rotation. A rotation including small grain, clover, and potatoes in the order named has been found to be particularly suited to sandy soils. Until the fertility of the type is well established the second crop of clover should always be plowed under as a green manuring crop. Where conditions have been made favorable alfalfa has been successfully grown on the Plainfield fine sand. Inoculation is necessary to secure a good stand. The soil is adapted to early truck crops, and the trucking industry could be profitably extended over a large part of the type.

An effort should be made to check wind drifting in areas which are subject to damage from this source by laying out the fields in strips, the cultivated strips to alternate with others which should be kept covered by growing crops to serve as windbreaks. Farms range in value from $15 to $50 an acre.

PLAINFIELD SANDY LOAM.

The surface soil of the Plainfield sandy loam consists of a brown to dark-brown sand, of loose, open structure about 8 inches deep. The subsoil is a brownish-yellow sand, to a depth of 2 feet, where it becomes sticky and slightly coarser, often grading into a sandy clay, which becomes heavy and plastic at 30 to 36 inches. Gravel beds and lenses of sand and gravel are found in the subsoil and evidences of stratification are frequently apparent.

The type is inextensive and of little importance. The most important area, containing about 1 square mile, is found in the northern part of Newport Township, along the county line, 5 miles east of Kilbourn. A small patch one-half square mile in extent occurs directly across the river from Portage.

The topography is level to undulating, the surface having been influenced somewhat by wind action, which has formed low ridges. The intervening depressions are sometimes without surface drainage, but the ridges are well drained and in places droughty. The area near Portage is level and a part of it is in need of tile drainage.

The type has the same origin as the Plainfield sand and represents valley fill of the old Wisconsin River. The area east of Kilbourn lies at about the same elevation as the Plainfield sand area in that region, while the tract south of Portage is much lower. The litmus test indicates that the surface soil is acid.

The original forest growth was similar to that found on the Plainfield sand.

Most of the type is under cultivation to the general farm crops. Corn yields 35 bushels, oats 25 bushels, rye 20 bushels, potatoes 100 bushels, buckwheat 15 bushels, beans 12 bushels, and hay about 1 ton to the acre. Few farmers continue the same crop for more than two years and clover is grown every 6 to 7 years. The soil, particularly on the higher areas, does not seem to be well suited to grasses, but truck crops do well. The soil is easy to cultivate, and with careful methods good yields are secured.

The type as a whole is in need of humus-forming material. More attention should be given crop rotations suited to the type, and more thorough methods of cultivation and fertilization should be practiced. The depressions require drainage. The acidity of the soil can be corrected by the application of ground limestone. The plowing under of green crops should become more common. Alfalfa

could be successfully raised if the land were given the proper treatment. Land of this type ranges in value from $30 to $60 an acre.

PLAINFIELD SAND.

The surface soil of the Plainfield sand consists of a light-brown, loose, incoherent sand of medium texture extending to an average depth of 9 inches and containing only a very small amount of organic matter. The subsoil consists of a yellow, medium sand, becoming lighter in color with depth. The material is loose and incoherent. It becomes coarser at depths of 18 to 30 inches, and lenses of gravel are encountered at 3 to 4 feet. No stones of over a few inches in diameter are present in either soil or subsoil, and limestone fragments are absent, the gravel consisting chiefly of quartz, flint, chert, quartzite, argillite, gabbro, and a few other rocks.

The type is of limited extent and confined to the northwestern corner of the county, east of Kilbourn, where it covers an area of some 3 square miles. Another small tract of less than a square mile is found on the south side of the Wisconsin River at Portage.

The surface of the type was originally level or nearly so, but has been modified by wind action until at present it consists of drifts, hummocks, and intervening depressions, with some level stretches. Differences in elevation rarely exceed 30 feet and are usually considerably less. The depressions have no surface drainage, but over the remainder of the type the natural drainage is good, frequently being excessive. The area south of Portage is level.

At Kilbourn the type represents a river fill of the old Wisconsin River from 160 to 190 feet above its present level. The area south of Portage is only a little above the present level of the river. All of the soil material has been reworked and deposited by water action when the river flowed at higher levels. The parent rock from which much of the sand was derived is the Potsdam sandstone. The type as a whole is in an acid condition.

The original forest growth consisted chiefly of burr, white, and red oaks, hickory, and poplar.

Not over 35 per cent of the type is under cultivation. During favorable seasons, and when properly fertilized and cultivated, corn yields about 25 bushels, rye 15 bushels, buckwheat 15 bushels, and clover and timothy hay 1 ton per acre. Average yields are slightly below those figures, and the type as cultivated is not well adapted to general farm crops, being droughty and of low fertility. Potatoes do fairly well and truck crops give fair returns when properly cared for.

This soil is deficient in organic matter. This constituent should be supplied by supplementing the stable manure with green manuring

crops, a practice which will also increase the water-holding capacity. The application of ground limestone will correct acidity, and when the fertility has been improved by the incorporation of manure and green crops, and commercial fertilizers where necessary, clover can be started. With a good stand of clover the productivity of the land can be maintained.

The trucking industry should be further developed on this type, and potatoes could be profitably grown to a greater extent than at present. The soil is early and responds quickly to careful treatment. Wind blowing should be prevented by cultivating alternate strips wherever the danger is greatest.

Farms on this soil range in value from $15 to $30 an acre.

FOX FINE SANDY LOAM.

The Fox fine sandy loam, to an average depth of 10 inches, consists of a brown fine sandy loam, containing enough silt and clay to make it slightly sticky when wet. The organic-matter content is higher than in the fine sand type. The subsoil is lighter in color than the soil and is a fine sandy loam in texture, becoming heavier in depth to a light sandy clay at 2 feet. Below this the texture becomes lighter again, becoming fine sand at less than 5 feet, though the details of texture in the subsoil are not uniform.

The only area of this soil in the county lies south of Pardeeville and covers a little more than a square mile. The topography is smooth and the natural drainage good, this being effected mainly through the soil.

In origin this soil seems to be derived from an area of glacial outwash material. It lies from 10 to 15 feet above the level of Fox River. All of the area is in cultivation and gives fair yields of the general farm crops. It is better adapted to the growth of truck crops, however, than to the general farm crops, especially early truck. Its light subsoil causes it to be subject to injury by dry weather, though the good depth of soil overlying the lighter subsoil reduces this injury to a minimum. Its adaptability to trucking is the same as that of the Plainfield fine sandy loam, and its fertility is somewhat higher. This is thought to be due to its larger content of limestone material. It has been differentiated from that soil solely on this basis.

FOX FINE SAND.

The Fox fine sand consists of a loose, incoherent, light-brown fine sand to a depth of about 10 inches. It is free from gravel and stones, and its organic-matter content is low. The subsoil consists of a yellow fine sand. The material is loose and incoherent and becomes lighter in color with depth. Lenses and beds of gravel occur in places in the subsoil. Low-lying areas are dark in color.

The type occurs rather well distributed in a north and south belt extending across the central belt of the county. The largest area lies in the vicinity of Pardeeville and down Fox River from that place. It is closely associated with Clyde soils and areas of Muck and Peat.

The topography is essentially level except where the sand has been blown into low dunes. These, however, are usually absent from areas of this soil.

The open texture of the subsoil insures thorough drainage, notwithstanding the level topography. In places the subdrainage is so complete that crops suffer from drought.

The type is derived from the weathering of glacial outwash sands. The lenses and beds of gravel present contain considerable limestone which is the chief reason for separating the type from the Plainfield fine sand. By the litmus paper test the soil is acid. The original forest growth consisted largely of oaks, with softwood trees in low, moist places.

By far the larger part of the area is under cultivation, being utilized for the growth of the general farm crops. Corn gives yields somewhat above 25 bushels per acre when the crop is well cultivated, oats 20 to 25 bushels, rye 15 to 20 bushels, wheat 12 bushels, buckwheat 15 bushels, hay about 1 ton, and potatoes about 100 bushels. These yields are the minimum yields that should be obtained. Some tobacco is grown, and yields of 1,000 to 2,000 pounds per acre are obtained. Beans yield 12 to 15 bushels. When heavily manured the yields of cucumbers run as high as 150 bushels per acre. With liming and fertilization alfalfa could be grown on this soil.

The soil is easily cultivated and responds readily and fully to fertilizers and to methods of treatment tending to the improvement of the soil. Little has been done, however, toward the adoption of a system of rotation adapted to the improvement of the soil, which is in need of organic matter and fertilizers. As the soil is very leachy, both of these must be applied continually. Peat beds are located near all the important areas of the type, and this could be spread upon the land and plowed under to supply organic matter. This should be supplemented with farm manure or commercial fertilizers which are high in their content of phosphoric acid and potash. The acidity of the soil, where it is pronounced, could be corrected by the application of ground limestone, and where this is done the nitrogen supply can be increased by the growth of clover. A good rotation for this soil would include grain, clover, and potatoes, the second crop of clover being plowed under, for a few years at least, in order to accumulate a supply of nitrogen and organic matter and to fill the soil with clover seed.

KNOX SILT LOAM.

The surface soil of the Knox silt loam consists of a smooth, light-brown to grayish silt loam, about 10 inches deep, containing only a comparatively small quantity of organic matter. The subsoil consists of a yellowish-brown silt loam, becoming slightly heavier with depth and grading into a light silty clay loam below 18 inches. Below 2 feet small white mottlings are quite common. The underlying rock is not encountered within the 3-foot section at any point. The type is free from gravel, stones, and bowlders, and is quite uniform throughout, although considerable fine sand is incorporated with it along the borders of adjoining sand types.

The Knox silt loam is of very small extent, occupying a little over 1 square mile. It is confined to the vicinity of Kilbourn, in the northwestern corner of the county.

The surface of the type is gently rolling. It is cut by several narrow gorges from 10 to 50 feet deep and gullied on the slopes. The natural drainage is good. On account of the silty character of the soil and the position which it occupies, the type is subject to erosion, and gullies once started advance rapidly during heavy rains.

The type consists mainly of wind-blown loess material resting upon the Potsdam sandstone or residual sand from this rock. It is identical with the light-colored upland soils throughout the southwestern part of Wisconsin, and the same type has been mapped in Iowa and La Crosse Counties. The surface soil is usually in an acid condition.

The original forest growth consisted chiefly of white and red oak, hickory, and some basswood, with a few other varieties of hardwood. Practically all of this growth has been removed, except from some of the steeper slopes.

Nearly all of the type is devoted to general farm crops or dairying. Corn averages 40 bushels, oats 35 bushels, wheat 20 bushels, and mixed clover and timothy hay 1½ tons per acre. Irish potatoes yield about 135 bushels per acre. No systematic crop rotation is followed, but the same crop is seldom grown on the same field for more than two years in succession. Clover is grown every 7 or 8 years. All of the stable manure produced on the farm is applied to the soil, and some is hauled from Kilbourn. The soil works into a mellow seedbed without difficulty, if cultivated under the proper moisture conditions, though it will clod somewhat if plowed while too wet.

The Knox silt loam is low in organic matter, and should be well supplied with stable manure and green manuring crops. The dairy industry could be further extended, and more live stock should

be raised. A broader range of the ordinary farm crops could be produced, and the type is also fairly well adapted to a number of truck crops.

BOONE SAND.

The surface soil of the Boone sand consists of a gray or grayish-brown fine sand about 8 inches deep, somewhat darker over the lower slopes, due to accumulations of organic matter. The subsoil consists of a light-yellow fine sand, becoming slightly darker with depth. In some places a reddish tinge is noted below 20 inches, and the deep subsoil is frequently mottled with red iron stains. In some places the underlying Potsdam sandstone is within reach of the auger and often outcrops.

The type is confined to the northwestern part of the county, where it is associated with the Knox silt loam, occupying the lower slopes, bordering the Wisconsin River valley. It is of very limited extent, occupying only about 1 square mile. The type occurs on steep slopes, and is often badly eroded. Owing to the sandy nature of the soil and its topographic position, the natural drainage is excessive. The material composing this type has been derived from the weathering and disintegrating of the Potsdam sandstone.

The forest growth consisted of pine, fir, spruce, oak, and hickory. A large part of the type is still forested, though most of the valuable wood has been removed. With the exception of a few small gardens in the northern part of Kilbourn, the type has not been used for growing crops, but is mainly in pasture.

Garden crops might be grown more extensively, and small fruits and berries could probably be grown successfully on the slopes. At best its agricultural value is low. Where too steep to cultivate it might be advisable to reforest the types.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Boone sand:

Mechanical analyses of Boone sand.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
311527	Soil	0.8	16.4	20.2	29.9	4.0	21.7	6.9
311528	Subsoil	.3	21.0	29.1	32.7	2.2	10.1	4.5

GENESEE SAND.

The surface soil of the Genesee sand consists of a loose, incoherent sand about 8 inches deep, varying in color from a light brown to gray or pale yellow, according to moisture conditions and organic-matter

content. The subsoil is a light-yellow, loose, incoherent medium sand extending to a depth of 3 feet or more and frequently carrying lenses of coarse sand and gravel. The type is very similar in texture to the Plainfield sand, but differs from that type in that it lies within the present flood plain and is subject to annual overflow. The type is of limited extent and confined to the Wisconsin River valley. One area occurs about 5 miles west of Portage, while another is found 7 miles to the south, on the east side of the river.

The topography is level, except where broken by undulations due to wind action and depressions representing old sloughs. The type is low and subject to overflow. The water table is comparatively near the surface, but the soil becomes droughty during the dry summer months when the river is low. The material forming the Genesee sand is all of alluvial origin and has been deposited by the Wisconsin River during times of high water. The parent rock contributing most largely to this material is the Potsdam sandstone, in most cases first influenced by glacial action.

The forest growth consists of swamp oak, willow, sycamore, elm, and ash. All of the best trees have been cut.

The type is used principally as pasture, being very sandy. Protection from flood waters will be necessary before it can be devoted to cultivated crops.

If protected this type would be of the same value agriculturally as the low-lying phase of the Plainfield sand found along the Wisconsin River. It is doubtful if its extent and value would justify the construction of levees to prevent flooding.

GENESEE FINE SAND.

The surface soil of the Genesee fine sand consists of a loose, incoherent, grayish to light-brown fine sand about 8 inches deep, containing only a small amount of organic matter. The subsoil is a yellowish fine sand of the same texture and structure as the soil and considerably more than 3 feet in depth.

The type is subject to considerable variation in color, texture, and depth. The surface soil has been wind blown in places into low dunes. On the crest of such dunes the soil is light, while in the depressions and old sloughs the material is loamy and darker colored, owing to the accumulation of organic matter in varying amounts. Small areas of peat, silt, sand, and gravel are encountered, although none of these variations are large enough to be indicated on the soil map.

This type is confined chiefly to the valley of the Wisconsin River, where it occupies islands and low sand flats bordering the stream. All such areas are subject to overflow. An area several square miles

in extent is found due west of Portage, with other tracts to the south on both sides of the river. The type is of minor importance, occupying in all only about 8 square miles.

The topography is level, except for the undulations caused by wind action and some old stream channels which cut across the type in a number of places. The surface is low, subject to annual overflow and usually wet during the spring and early summer months. During dry spells when the river is low the soil is well drained.

The material forming this soil is of alluvial origin, modified somewhat by wind action. The parent rock is the Potsdam sandstone, although in many places this has been influenced by glacial action. The soil of this type is usually in a slightly acid condition.

The forest growth consisted chiefly of swamp oak, sycamore, basswood and willow, with some ash and elm. The best of this growth has been cut, but there is still a fair stand of trees and considerable undergrowth over most of the type.

All of the type is subject to overflow. Some of it lies between the levee and the river, though most of it occurs where no levees have been constructed. Little attempt at improvement has been made for this reason. Aside from the marsh hay, which can be cut from a portion of the type, and the pasture which it affords, it has but little present agricultural value.

Levees might be constructed to protect this soil from overflow, but the amount of desirable land which could thus be reclaimed is hardly sufficient to warrant the extension of such enterprises. If protected from overflow the type would have the same agricultural value as the low-lying phase of the Plainfield fine sand. Its present value depends chiefly on the hay and pasture it provides.

CLYDE SILT LOAM.

The surface soil of the Clyde silt loam consists of a black or dark-brown smooth silt loam extending to an average depth of 14 inches and containing a large quantity of organic matter. The subsoil becomes lighter in color and heavier in texture with depth, until at 18 inches a drab silty clay loam showing a few yellow iron oxide stains is encountered. At 2 feet the subsoil approaches a clay loam and at 3 feet shows yellow or light drab, with iron stains.

Lenses of fine sand, crystalline bowlders, and limestone fragments are frequently found throughout the soil section. Over limited areas the bowlders are sufficiently numerous to interfere with cultivation. The variations which occur in the type, however, are of minor importance.

The Clyde silt loam is found associated with the Miami silt loam, deep phase, and to a lesser extent with the Carrington silt loam, deep phase. It covers approximately one-third of Columbus Township,

in the southeastern part of the county. The type occurs throughout the eastern third of the county as long, narrow bands bordering stream courses. A well-developed area is found along the Baraboo River, to the south and west of Portage, while smaller tracts occur along Spring Creek between Lodi and the Wisconsin River and in various other parts of the survey.

The surface of this type is level to undulating, with a gentle slope toward the stream along which it occurs. In the larger areas there are a few old sloughs and abandoned stream channels, which produce a slight irregularity in the surface. On account of its low position, even surface, and the heavy character of the soil the natural drainage is very defective, and the establishment of drainage systems is essential before the type can be successfully used for the growing of cultivated crops. Very little of this type is subject to overflow, but it occupies low situations and is generally wet, especially in the spring and early summer.

The type represents old ponded valleys, lake beds, and other shallow depressions due to the uneven distribution of glacial till, and the soil is in part of alluvial origin. Its low position and moist condition have favored the accumulation of organic matter, which has imparted a dark color to the soil. As the type is derived partly from calcareous drift, it is rarely acid.

The original forest growth consisted chiefly of elm, ash, soft maple, willows, and other moisture-loving trees and shrubs.

Comparatively few areas of the Clyde silt loam are under cultivation, but wherever adequate drainage has been provided excellent crops are being grown. Corn yields an average of 50 bushels per acre, while yields of 80 bushels are often reported. Grass makes a rank growth, and timothy hay yields 1½ to 2 tons per acre. Alsike clover does well. Small grain is apt to lodge, but yields of 25 to 40 bushels per acre are obtained. The quality is inferior to that raised on the Miami soils. Peas are grown to a limited extent, but run too much to vine to give the best results. Sugar beets yield from 12 to 18 tons per acre, but the sugar content is lower than from beets raised on the lighter-colored upland types. Cabbage also does well on this type.

The most common system of cropping consists of hay for one or two years, after which the sod is plowed for corn, sometimes being manured first, and followed a second year by the same crop. A small grain is usually sown after the second corn crop and the field again seeded to timothy or a mixture of timothy and alsike.

Where drainage is well established and the soil worked under favorable moisture conditions but little difficulty is experienced in securing a good seed bed. The soil is rather heavy, however, and if worked when too wet or too dry is apt to prove refractory. Con-

siderable forest is still standing, and uncultivated areas are used for pasture.

The Clyde silt loam is naturally a very strong, productive soil. Adequate drainage is its greatest need. There are many long, narrow areas where a single line of tile would be sufficient to drain the land. In larger tracts main tile ditches with laterals would be found necessary. Conservative estimates place the cost of tiling at $25 to $35 an acre, and although there are places where open ditches might be effective, tile drains are preferable wherever economic conditions will permit their installation.

After a few years of cropping this type frequently becomes deficient in potash and phosphoric acid, and commercial fertilizers supplying these constituents are found beneficial. There is an abundant supply of nitrogen, and for this reason it is advisable to save the stable manure for the upland soils and supply the mineral elements by the use of commercial fertilizers. The type is adapted to a wide range of crops, and when once reclaimed will add to the agricultural wealth of the county.

The following table shows the average results of mechanical analyses of samples of soil and subsoil of this type:

Mechanical analyses of Clyde silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
311505, 311547	Soil	0.0	0.2	0.8	6.1	8.8	63.9	19.9
311506, 311548	Subsoil	.0	.3	.8	4.1	7.7	73.9	13.1

CLYDE LOAM.

The Clyde loam consists of about 12 inches of black loam containing considerable silt and organic matter and underlain at a depth of about 20 inches by a drab clay loam, mottled with yellow and containing lenses of fine sand. This material becomes heavier and the mottling more pronounced at depths ranging from 20 to 36 inches.

The type is subject to considerable variation. In places the subsoil is a drab loam grading into a sandy clay loam, underlain at 2 feet or more by a sticky fine sand, becoming loose and incoherent in the lower portion. In places from 5 to 6 inches of fine sand may be found immediately underlying the surface soil. A covering of 4 to 5 inches of peat is found over a few small areas, the subsoil being a mixture of sand and clay. None of the phases were of sufficient extent to map separately, but the whole type, with all of its variations, is quite characteristic of the material usually classed as the Clyde loam.

The type is of small extent, occupying less than 11 square miles in the county. It occurs principally in Fort Winnebago, Marcellon, and

Otsego Townships, with a few other small patches in different parts of the county. Most of the type is associated with the Coloma soils rather than with the Miami, as is the case with the silt loam type.

The topography is level, which, with the low position of the type, makes the natural drainage poor. The water table is usually within a few feet of the surface, and during the spring the soil is almost completely saturated. At times portions of the type are several inches under water. This soil is similar in origin to that of the Clyde silt loam. It occupies low, flat areas and depressions representing old lake beds or swamps and ponded valleys, and contains some alluvial material along present streams. The dark color is due to the accumulation of organic matter resulting from decaying vegetation in the presence of moisture. The surface soil is sometimes slightly acid, especially where this type is associated with the Coloma series.

The original forest growth consisted chiefly of elm, ash, sycamore, willow, quaking aspen, swamp oak, and other water-loving trees and shrubs. Nearly all the valuable trees have been removed, only a scant growth remaining over the type.

Where properly drained the type is well suited to a number of general farm crops. Corn averages about 35 bushels per acre and oats 25 bushels, although this crop is likely to develop too much straw and lodge. Hay yields about 1½ tons per acre. Both timothy and alsike clover do well. Potatoes frequently yield 110 bushels per acre. A large part of the type is unimproved and in its present undrained condition is of value chiefly for the pasture it affords.

When improved by a system of tile drains and by open ditches where tiles can not be installed the type will be found adapted to a wide range of crops. The use of potash and phosphoric acid may be necessary in maintaining the fertility of the soil after a few years' cultivation. The soil is high in nitrogen. Where an acid condition exists this may be corrected by applying ground limestone. The portion of the type associated with the Miami upland soils will, when improved, doubtless have a higher agricultural value than where associated with Coloma soils, owing to the greater content of lime carbonate.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of the Clyde loam.

Mechanical analyses of Clyde loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
311555	Soil	0.5	10.8	10.8	11.8	4.0	37.9	23.6
311556	Subsoil	.2	11.5	13.2	17.5	11.2	22.1	23.9

CLYDE FINE SANDY LOAM.

The surface soil of the Clyde fine sandy loam consists of a loose and open fine black sand to fine sandy loam, 12 inches deep, containing considerable organic matter. The subsoil is a dark-drab fine sand, becoming lighter with depth, and grading at about 18 inches into a sticky fine sand or a light sandy clay. The texture then becomes heavier, and at 2 feet a sandy clay is encountered.

The type is subject to considerable variation, though as a whole it conforms more closely to a fine sandy loam than to any other type. The surface is frequently covered with 2 to 3 inches of Peat or Muck, which becomes incorporated with the soil as soon as the type is put under cultivation. Areas of limited extent often have a surface covering approaching a loam in texture, though where this is found the type is always shallow and underlain by fine sand.

This type is of comparatively small extent and is found in the lowlands associated with other soils of the Clyde series. In all about 24 square miles were mapped. The type occurs in small areas in many parts of the county. These are most numerous in Otsego and Fountain Prairie Townships.

The topography is level, the low position of the type and the proximity of the water table to the surface making natural drainage poor.

The type is derived from the aggregation by stream action of the fine sand and other material washed from the adjoining higher-lying land. Accumulations of organic matter, favored by abundant moisture and decaying vegetation, have imparted a darker color to the soil. Portions of the type are acid, usually where associated with Coloma soils.

The original forest growth consisted of swamp oak, willows, elm, sycamore, quaking aspen, and sumac. Little valuable forest remains, though most of the type is still uncleared. Some marsh grasses are also found.

Not over 10 per cent of this type is under cultivation, although where open ditches have been constructed and the land drained, yields of 30 bushels of corn, 25 bushels of oats, 20 bushels of buckwheat, 100 bushels of potatoes, and about 1½ tons of timothy and clover hay to the acre have been secured. Little, if any, attempt has been made to specialize on this soil, and rotations best suited to local conditions have not been worked out. When properly drained the type is easily worked and no difficulty is experienced in putting the fields into good physical condition.

The type is well supplied with organic matter and nitrogen, but after a few years of cultivation it is probable that commercial fertilizers containing phosphoric acid and potash will be found helpful. The greatest need of the Clyde fine sandy loam at present is drainage.

With the construction of open ditches and tile drains a large part of the type could be reclaimed and made to produce profitable yields of general farm crops and some truck. The portion of the type associated with the Miami soils will doubtless have a higher value when reclaimed than where associated with the Coloma soils, owing to the greater amount of limestone material present.

The price of land of this character ranges from $15 to $30 an acre.

CLYDE FINE SAND.

The Clyde fine sand consists of a fine black sand about 12 inches deep, containing a large amount of organic matter and underlain by a loose, drab, fine sand, showing mottlings of yellow in the lower part of the soil section. Variations from the typical soil occur over limited areas, but are not important enough to show on the map.

The type is inextensive and of minor importance, occupying a total area of 1 square mile. It is associated chiefly with the Clyde fine sandy loam. One small area lies immediately east of Pardeeville, with another about 5 miles to the east, and smaller patches in other parts of the county.

The surface of the type is low and flat, and on account of its position and the proximity of the water table to the surface the natural drainage is poor.

The material composing the type has been washed from the higher lands adjoining the Miami soils and deposited in low places. The darker color is caused by accumulations of organic matter resulting from the partial decay of vegetation in the presence of moisture.

The native vegetation consists principally of grasses and sedges, with a few willows. Only a very small part of the type is cultivated, but where properly drained good crops can be secured. It is adapted to about the same crops as the Clyde fine sandy loam and requires similar treatment.

PEAT.

The material mapped as Peat consists of black or dark-brown vegetable matter in varying stages of decomposition, with which there has been incorporated a small amount of mineral matter. This varies in depth from 2 to 20 feet, with an average of 3½ to 4 feet. The upper portion of the peat beds is usually quite fibrous, the material becoming more thoroughly decomposed with depth, forming in the lower portion a soft mass which is sufficiently tenacious to be molded into different forms by the hand. When dry this decomposed Peat somewhat resembles a black carbonaceous clay. Where encountered in areas of sandy soils the underlying material is frequently sandy, while in the region of heavy upland soils the underlying material is clayey.

Extensive areas of Peat are found in the lowlands in the vicinity of Portage, along the Wisconsin and Fox Rivers, in Pacific and Fort Winnebago Townships. Other large areas lie along Duck Creek, between the Wisconsin River and Cambria, and in Lewiston and Newport Townships, while smaller patches occur in nearly all parts of the county, except in the prairie regions and the hilly section of Caledonia Township.

The peat beds occupy low, flat areas, and on account of their position and the fact that the water table is so close to the surface the natural drainage is very poor.

The Peat has been formed through the growth and partial decomposition in the presence of water of a rank vegetation, the black or dark-colored material being formed largely from grasses and sedges, while that having a brown color was formed chiefly from sphagnum moss. About the margin of the larger marshes and over the greater part of many of the smaller ones varying quantities of soil from the adjoining higher land have been washed in and incorporated with the vegetable matter. Wherever this has been sufficient to materially change the texture and structure of the material it has been separated and mapped as Muck.

The peat beds occupy old lake basins, ponded valleys, kettle basins, glacial sloughs, and other depressions in the uneven surface developed by the ice sheet. Peat may also be found within the flood plain of many of the present streams.

Many of the peat marshes are in an acid condition.

The native growth over Peat is confined to several varieties of grasses, sedges, and some arrowhead, cattail, and various reeds and rushes. On the sphagnum-moss peat beds are found tamarack, sumac, huckleberry, and quaking aspen. Where the Peat is shallow elm and ash are sometimes found.

In Columbia County scarcely any of the Peat has been improved beyond ditching in order that marsh hay may be secured. On a large number of farms the peat marshes are the chief source of hay, and in many cases they are used as pastures. The hay is cut from early in July to early in September. One ton per acre is about the average yield.

The greatest need of this type is drainage. Many of the peat marshes are so situated that they can be drained by large, open ditches, and later, when the land has settled sufficiently, tile drains may be installed as laterals leading into the open drains. When properly drained, cultivated, and fertilized, excellent crops can be secured from such areas. The Peat is very rich in nitrogen, and it would therefore be advisable to use commercial fertilizers in preference to stable manure, which might better be used on the upland soils.

The Peat is low in potassium and phosphoric acid, both of which are supplied by the use of commercial fertilizers. Phosphorus may be added in the form of rock phosphate. Ground limestone applied at the rate of 1,200 to 2,000 pounds per acre will correct the acidity and keep the Peat in a sweet condition for 4 or 5 years. Soil from the upland may be spread over the Peat and worked in with good results.

When reclained this type will be found adapted to a wide range of crops. Corn, hay, oats, potatoes, onions, celery, cabbage, and peppermint are being successfully grown on this material in other places. Practically all of the Peat is held in connection with upland farms and ranges in value from $5 to $20 an acre.

MUCK.

The material mapped as Muck consists of partially decomposed vegetable matter, with which there has been incorporated a considerable quantity of mineral matter. The Muck is black or nearly black and extends to a depth of 8 to 24 inches. The underlying material consists for the most part of a drab or grayish fine sand. Variations in the type are numerous, though comparatively inextensive. The most common of these is where the sand or silt from the upland has been washed down and deposited over a peat bed, thus developing a phase of Muck having a high content of mineral matter near the surface, but underlain by Peat. In places small peat beds have been drained for a long period, allowing the surface soil to decompose in the atmosphere, bringing about a concentration of the mineral matter of the Peat and producing a black Muck, containing some fine sand underlain by Peat, which becomes comparatively pure with depth. The surface of such muck beds when dry and under cultivation is subjected more or less to wind erosion. In a few places the material underlying the Muck is a clay or silty clay.

The Muck is not nearly as extensive as Peat, the largest tract being found along the headwaters of the Fox River, northeast of Pardeeville. The type is confined largely to the eastern part of the county. It occupies low, flat areas in old lake beds, kettle basins, stream channels, and ponded valleys, all of which abound in this glacial region.

On account of its position and the nearness of the water table to the surface, the natural drainage is poor.

The origin of the largest muck beds in the area is identical with that of the Peat, except that in general the Muck has been exposed to the atmosphere, has undergone a more thorough decomposition, and has a much higher mineral-matter content.

Litmus tests indicate that at least a part of the type is in an acid condition.

The vegetation of the muck beds consists of willows, quaking aspen, sumac, ash, swamp oak, and various wild grasses. Where the grasses abound there is usually no other growth, except a few scattered willows.

Except for the production of marsh hay, this type has been improved only to a limited extent. A small amount of drainage work has been done, including the construction of a few open ditches, but the greater part of the Muck is still undrained. Where drained and properly cultivated satisfactory yields of corn, oats, onions, cabbage, and a number of other crops can be secured.

The Muck is deficient in phosphorus and potash, which can be supplied in the manner suggested for the Peat. Smaller applications may meet the requirements of this type, since it carries considerable mineral matter. Where the material is sour, ground limestone should be applied to correct the acidity. Corn, oats, potatoes, peppermint, onions, cabbage, celery, and a number of other crops are successfully grown on reclaimed areas of Muck in other sections, and these crops should do equally well in Columbia County.

ROUGH STONY LAND.

The areas mapped as Rough stony land consist of steep, rocky slopes, upon which the covering of soil is very thin and where rock fragments and outcrops are numerous. The soil on these slopes is usually a fine sand, which in the absence of the rocks could be mapped as Boone fine sand. The type is confined to the southwestern part of the county, where it occurs as long, narrow bands along the steepest hill slopes. In a few instances it extends over the tops of hills.

Because of the steepness of the slope and the sandy nature of the soil, the natural drainage is excessive and the vegetation suffers from lack of moisture.

The sandy soil has been derived from the weathering and disintegration of the Potsdam sandstone, which forms the walls of the old preglacial valleys on the slopes of which the Rough stony land is found. Most of the outcrops are also Potsdam sandstone, although a few of the hills are capped with Lower Magnesian limestone. Limestone fragments are sometimes mixed with the sandstone.

Where a forest growth occurs on these slopes it is usually scrubby oak or hickory. Many of the steeper slopes are bare except for some grass.

The Rough stony land is a nonagricultural type and of value only for the small amount of pasture which it affords. Its only other possible use is for forestry, and it is doubtful if this could be made successful, because of the shallow, droughty nature of the soil.

SUMMARY.

Columbia County is located in south-central Wisconsin and comprises an area of approximately 799 square miles, or 511,360 acres.

The surface features vary from broad, undulating prairies to steep rolling lands, the roughest section being found in Caledonia Township and in the extreme southwestern corner of the county. There are but few places where modern farm machinery can not be readily used. The greater part of the surface is undulating to gently rolling. Low, marshy tracts are numerous throughout the county, especially in the valleys of the Wisconsin and Fox Rivers. These streams, with the headwaters of the Rock River, receive the drainage waters of the entire survey.

The county was visited by white men as early as 1673, though the first settlement was not made until 1836. It was organized in 1846, with Portage as the county seat. The county had a population of 31,129 in 1910.

Columbia County is well supplied with railroads, which provide excellent transportation facilities. It is but 93 miles from Portage to Milwaukee and 178 miles to Chicago. These cities provide excellent markets for farm produce.

The climate is healthful, and while there is a range of 130° in temperature throughout the year, the extremes are infrequent and of short duration. The mean annual temperature is 45.6° and the average annual rainfall 29.55 inches.

General farming in conjunction with dairying is the prevailing type of agriculture, although a number of special crops are grown. Wheat growing was at one time the leading industry of the county, but its production has declined and at present corn, oats, and hay are the most important crops. Of the special crops potatoes, tobacco, beans, peas, and sugar beets are the most important. The industrial development of the county has been such as to encourage the production of truck crops and fruits.

Stock feeding and the improvement of dairy and beef stock is receiving more attention throughout the county.

The adaptation of certain of the soil types to particular crops and the question of crop rotations, while quite generally recognized, should be more carefully studied. Potatoes are best adapted to the lighter soils. The sugar content in beets grown on the Miami silt loam, deep phase, is higher than of those grown on the Carrington or Clyde soils. The grain produced on the deep phase of the Miami silt loam is also of better quality than that grown on the black soils. Various other types are recognized as well suited to certain special and general farm crops. The farm improvements are more substantial on

the heavier types than on the sandy soils. As a whole the farming communities are in a prosperous condition. The average size of farms is 141 acres, and more than 75 per cent of the farms are operated by the owners.

Agriculture in the county could be improved through the extension of the dairy industry, the growing of more alfalfa, the increase of the organic-matter content of the soil, the use of lime to correct soil acidity, more thorough cultivation, a more careful selection of seed, and a better system of crop rotations.

Nine soil series, including 27 soil types, were recognized and mapped in the area. Of these the most important are the Miami soils represented by a deep phase of silt loam, loam, fine sandy loam, and fine sand. The series includes the light-colored, timbered glacial soils carrying considerable limestone material. The deep phase of the silt loam and fine sandy loam members are extensively developed and are important agricultural soils. They range in value from $40 to $100 an acre.

The Carrington series is represented by three types, the deep phase of the silt loam, loam, and fine sandy loam. The silt loam, deep phase, is the most extensively developed and constitutes some of the best agricultural land in the State. Tobacco and sugar beets are special crops grown to some extent on these soils. The members are well drained and extensively cultivated. The deep phase of the silt loam type ranges in value from $75 to $150 an acre, while the other types are held at lower prices.

The fine sandy loam and fine sand are the only members of the Coloma series mapped in the area, and both types are inextensive. The general farm crops, corn, rye, oats, and hay, are grown with good results. Potatoes are the leading special crop, yielding about 125 bushels on the fine sandy loam and slightly less on the fine sand. Land containing these types can be bought for $25 to $75 an acre, depending upon location and improvements.

Five types were mapped in the Plainfield series—the silt loam, fine sandy loam, fine sand, sandy loam, and sand. The fine sand is the most extensive member of the series. The general farm crops are grown on all five members with good results. Some tobacco and beans are grown on the fine sand, the tobacco yielding from 1,000 to 2,000 pounds and beans averaging from 12 to 15 bushels per acre. This soil is valued at $15 to $50 an acre.

Two types in the Fox series, the fine sandy loam and fine sand, were mapped. This series is similar to the Plainfield, except that it contains limestone material, especially in the subsoil. The types here are of limited extent and are adapted to the same crops as the Plainfield soils.

The Genesee sand and fine sand, Knox silt loam, and Boone sand are unimportant types of small extent. They are poorly drained and subject to overflow and are used principally for pasture and hay.

The Clyde soils are represented by four types—the silt loam, loam, fine sandy loam, and fine sand. The soils are rich in organic matter, but drainage is defective over all of the types, and except where reclaimed by ditching or levees little of the land is under cultivation. The silt loam is the most extensive type, and cultivated areas produce fair yields of the general farm crops.

No attempt has been made to utilize the areas of Peat and Muck, except for the production of wild hay.

Rough stony land is of little use except for pasture. It might possibly be improved by reforesting to hardwoods.

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[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the Congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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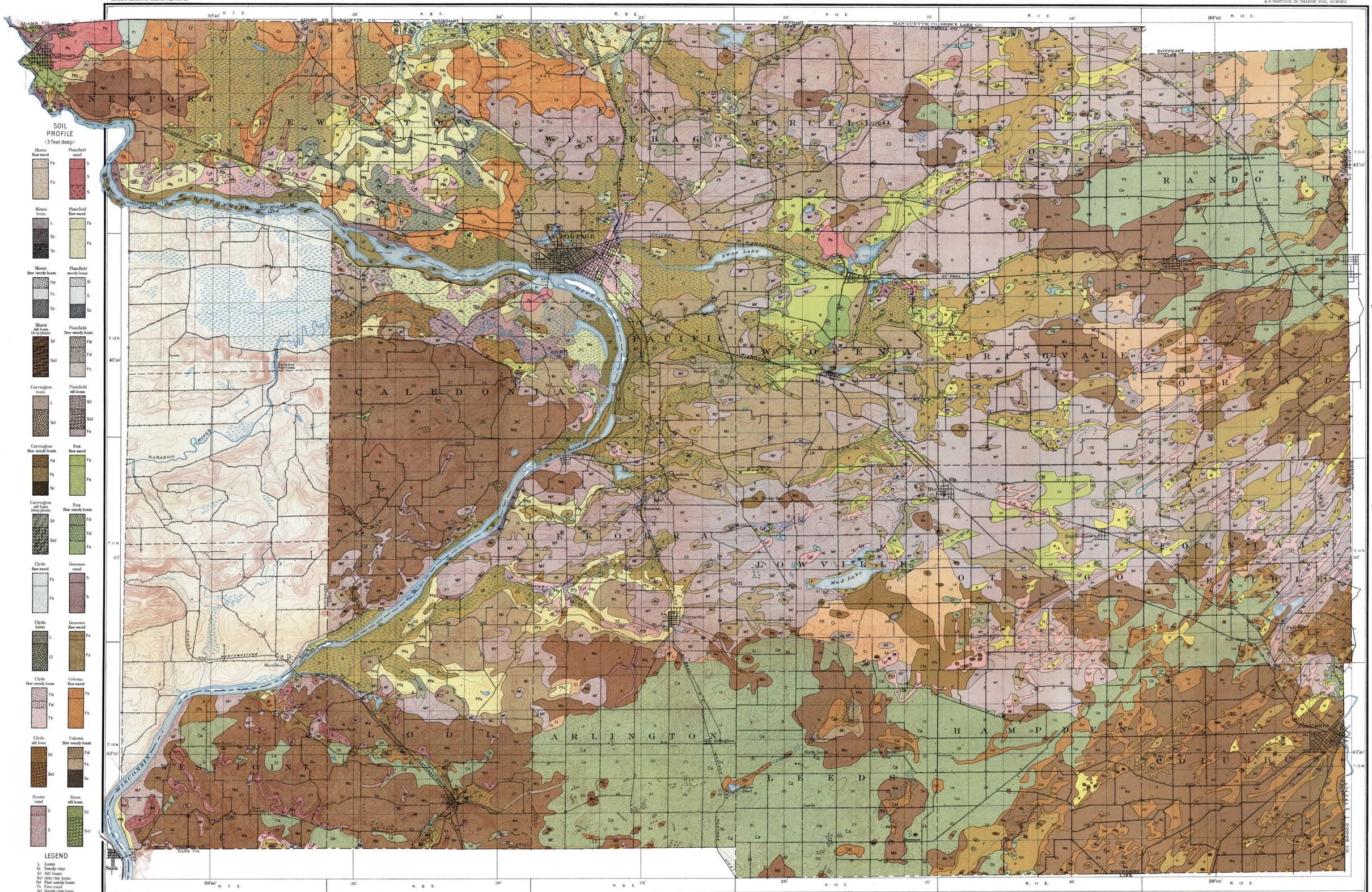
U. S. DEPT OF AGRICULTURE
BUREAU OF SOILS
MILTON WHITNEY, CHIEF
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
WISCONSIN
COLUMBIA COUNTY SHEET

STATE OF WISCONSIN
GEOLOGICAL AND NATURAL HISTORY SURVEY.
COLLEGE OF AGRICULTURE, UNIVERSITY OF WISCONSIN
H. L. RUSSELL, DEAN
A. R. WHITSON, IN CHARGE SOIL SURVEY.



SOIL PROFILE
(3 feet deep)

Miami fine sand — Fs, Fs
Plainfield sand — S, S, S
Miami loam — L, Sc, Sc
Plainfield fine sand — Fs, Fs
Miami fine sandy loam — Fsl, Fs, Sc
Plainfield sandy loam — Sl, S, Sc
Miami silt loam Deep phase — Sil, Sicl
Plainfield fine sandy loam — Fsl, Fsl, Fs
Carrington loam — L, Scl
Plainfield silt loam — Sil, Sicl, Fs
Carrington fine sandy loam — Fsl, Fs, Sc
Fox fine sand — Fs, Fs, Fs
Carrington silt loam Deep phase — Sil, Sicl
Fox fine sandy loam — Fsl, Fsl, Fs
Clyde fine sand — Fs, Fs
Genesee sand — S, S
Clyde loam — L, Cl
Genesee fine sand — Fs, Fs
Clyde fine sandy loam — Fsl, Fsl, Fs
Coloma fine sand — Fs, Fs
Clyde silt loam — Sil, Sicl
Coloma fine sandy loam — Fsl, Fs, Sc
Boone sand — S, S
Knox silt loam — Sil, Sicl

LEGEND
L Loam
Sc Sandy clay
Sil Silt loam
Scl Silty clay loam
Fsl Fine sandy loam
Fs Fine sand
Scl Sandy clay loam
Sl Sandy loam
S Sand
Cl Clay loam

LEGEND

Miami fine sand — Mi
Plainfield sand — Ps
Miami loam — Ml
Plainfield fine sand — Pfs
Miami fine sandy loam — Mf
Plainfield sandy loam — Pl
Miami silt loam Deep phase — Ms
Plainfield fine sandy loam — Pf
Carrington loam — Cl
Plainfield silt loam — Psl
Carrington fine sandy loam — Cfs
Fox fine sand — Ff
Carrington silt loam Deep phase — Ca
Fox fine sandy loam — F
Clyde fine sand — C
Genesee sand — Gs
Clyde loam — Cy
Genesee fine sand — Gf
Clyde fine sandy loam — Cyf
Coloma fine sand — Cs
Clyde silt loam — Csl
Coloma fine sandy loam — Cf
Boone sand — B
Knox silt loam — Kl
Muck — M
Peat — P
Rough stony land — R
Bowlders
Rock outcrop
Gravelly areas
Swampy areas

J. E. Lapham, Inspector in Charge Northern Division
Soils surveyed by W. J. Geib, and Arthur E. Taylor of the U.S. Department of Agriculture, and Guy Conrey of the Wisconsin Geological and Natural History Survey

BASE MAP IN PART FROM U. S. GEOLOGICAL SURVEY SHEETS

Scale 62500
1 0 1 2 3 4 Miles
1 0 1 2 3 4 Kilometers
Contour interval 20 feet, where shown.
Datum is mean sea level.

Field Operations Bureau of Soils 1911